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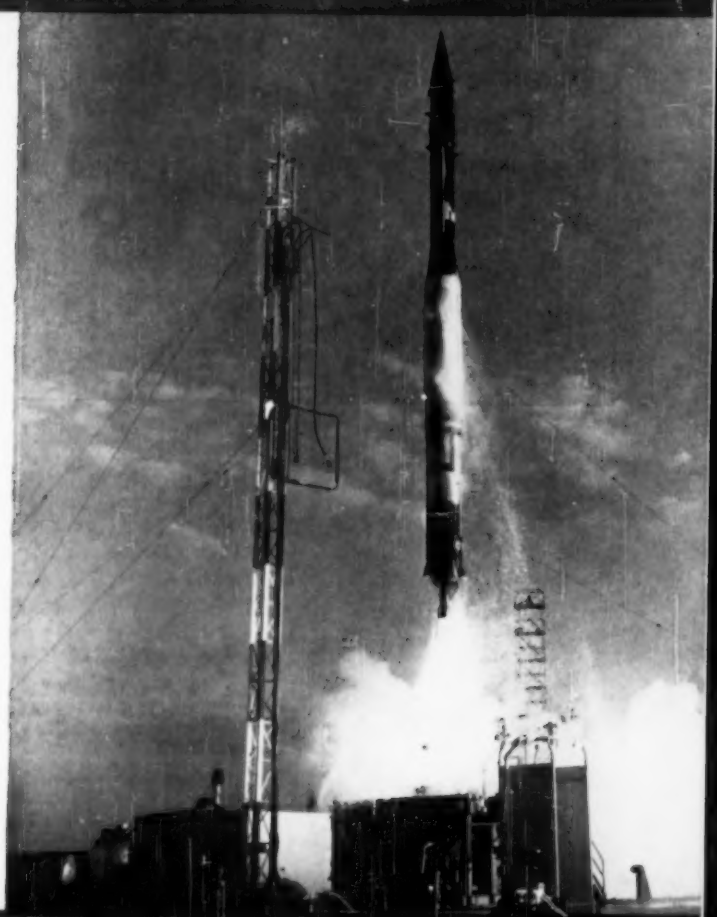

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Journal of the
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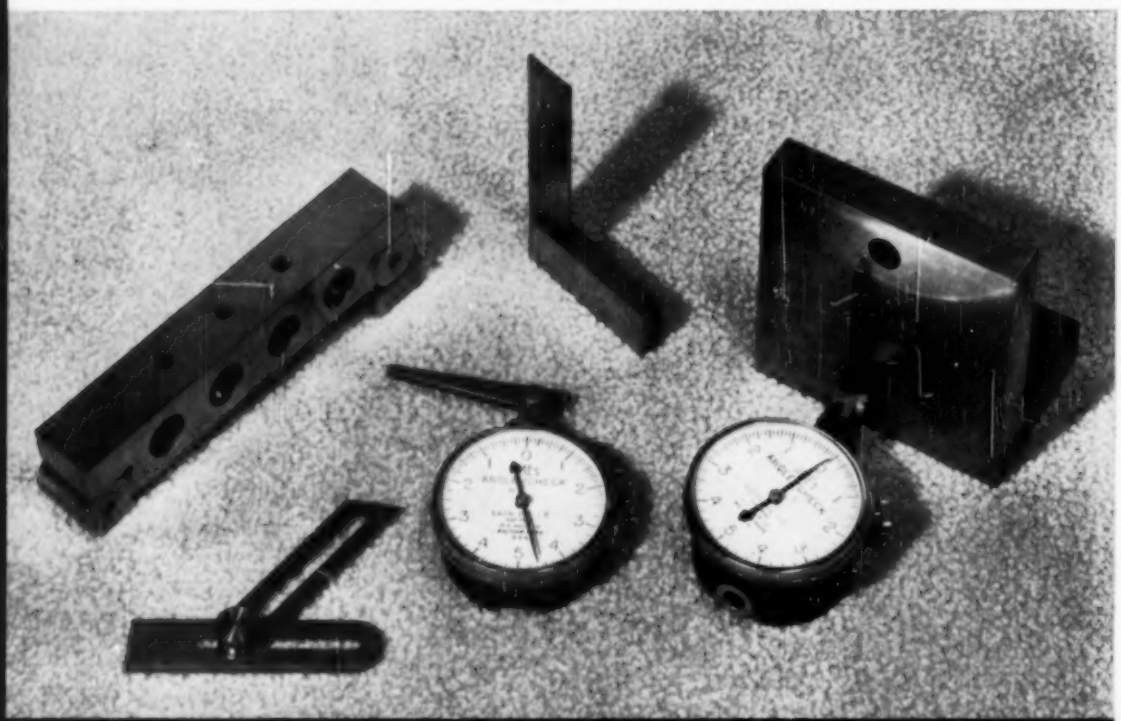

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Four-stage junction diode amplifier was developed at Bell Telephone Laboratories by Rudolf Engelbrecht for military applications. Operates on the "varactor" principle, utilizing the variable capacitance of diodes. With 400-mc. signal, the gain is 10 db. over the 100-mc. band.

The tremendous possibilities of semiconductor science are again illustrated by a recent development from Bell Telephone Laboratories. The development began with research which Bell Laboratories scientists were conducting for the U. S. Army Signal Corps. The objective was to reduce the "noise" in UHF and microwave receivers and thus increase their ability to pick up weak signals.

The scientists attacked the problem by conducting a thorough study of the capabilities of semiconductor junction diodes. These studies led to the conclusion that junction diodes could be made to amplify efficiently at UHF and microwave frequencies. This was something that had never been done before. The theory indicated that such an amplifier would be exceptionally free of noise.

At Bell Laboratories, development engineers proved the point by developing a new kind of amplifier in which the active elements are junction diodes. As predicted, it is extremely low in noise and efficiently amplifies over a wide band of frequencies.

The new amplifier is now being developed for U. S. Army Ordnance radar equipment. But it has numerous other possibilities. In radio astronomy, for example, it could be used to detect weaker signals from outer space. In telephony, it offers a way to increase the distance between relay stations in line-of-sight or over-the-horizon communications.

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Quality Control

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Rutgers University
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From the President's Desk

Professional Recognition

As was reported to you on this page by President Bass last June, substantial progress has been made in charting a course for the Society and for its individual members in the area of professional development. Since that time even further gains have been made and these will be reported to you in the very near future. It is important, however, that we take prompt advantage of such opportunities as have already been made available to us.

One of the early steps in the program to enhance our professional stature was the establishment, by constitutional provision, of more widely accepted professional requirements for the advanced grades of membership in the Society. As a result, our qualification requirements for the grades of *Senior Member* and *Fellow* are now in keeping with those of the recognized engineering societies of this country. You will recall, also, that earlier this year amendments to the Constitution were adopted establishing professional requirements for the *Member* grade and providing for a new non-professional, non-corporate membership, the *Associate Member Grade*.

It is recognized, of course, that the mere establishment of acceptable professional requirements for the several grades of membership will not, in itself, enhance the stature of the individual member. It does, however, provide a structure into which he may fit and by which he himself may gain professional recognition. The Society, through its Examining Committee, is working diligently to assure that a mechanism is available to provide for the advancement of qualified members to the grades of Senior Member and Fellow. The Committee has delegated to section examining committees certain of its authorities in connection with the advancement of members to the highest grade for which they qualify. Active participation in this program by all members of the Society is encouraged.

Our members seem to have a sense of modesty about their achievements and qualifications as Quality Control people, and this is an admirable personal trait. Nevertheless, Quality Control people collectively stand on the threshold of professional recognition, and therefore it behooves the individual to contribute to the effort by seeking the recognition to which he is entitled. By the very nature of requirements for Senior Member, those who qualify form a substantial segment of the hard core of the Quality Control profession, and it is essential that they "stand up and be counted" if ASQC is to be effective as their professional society.

I urge that each Member review his own qualifications in the light of the present requirements for the grade of Senior Member and to seek advancement if eligible. Section officers and section examining committees are active in this work and stand ready to assist in such reviews. It is suggested that you make known to your local examining committee any recent activities that may have a bearing on your status. Further, should you be approched by other members of the Society to consider advancement, I urge you to do so with the view of attaining a higher grade of membership.

Advancement to the grade of Fellow is by invitation of the Society's Examining Committee. Every effort is made by the Committee to keep informed of the contribution of the Senior Members of ASQC so as to be in a position to recognize those who meet the requirements for this higher grade. The help of all members and of the sections is needed to assure that qualified Quality Control people are afforded the rightful opportunity of advancement.

It should be the aim of all of us to maintain within the membership the highest professional status we can possibly enjoy within the limits of the very excellent professional requirements we have imposed upon ourselves. Accomplishment of this objective will assure substantial progress in our move toward improved professional stature.

C. E. Fisher

National Defense and Quality Control*

HONORABLE PERKINS McGUIRE

Assistant Secretary of Defense, Supply and Logistics

The subjects under discussion during this 1958 annual convention in Boston of the ASQC have a significant bearing on the operations of the Department of Defense, particularly in the area of Supply and Logistics.

It was near here that Wendell Phillips gave many of his famous orations. It was he who said that "whether in chains or in laurels, liberty knows nothing but victories." This is certainly a poetic expression of a very noble idea. But in the short term, this epigram doesn't seem very realistic. In our time and in the life span of our children—and our grandchildren—we cannot comfortably assume that democracy will triumph over the communist brand of slavery. Wendell Phillips spoke more realistically when he said that "eternal vigilance is the price of liberty." This is particularly true in the short term. In the larger perspective of history, we are confident that liberty will assert its superiority.

That leads me into the subjects I want to discuss because the prime function of the Department of Defense is the defense of liberty and national security. I want to talk about our Defense program generally—its problems and its progress. Then I would like to say a few words about the particular challenge that faces the Department of Defense in the general area of quality and reliability.

In considering our Defense posture as a nation, it is most important to keep in mind that we have military strength over the long pull only if we maintain a strong economy. In fact, some people believe that the ultimate showdown between this country and international communism might well be in the area of economic rather than military power.

Khrushchev has boasted many times that the Soviet Union will overtake and surpass the United States in industrial competition. More than a year ago he said, and I quote, "Now the Soviet Union, the peoples of formerly backward Russia who took power into their own hands, have built an economy with a socialist base, created a mighty industry, raised production, carried out collectivization, established state farms, and are now in a position to equal the U. S. level of per-capita production and even to surpass that level. . ." This may be mere boastfulness. But the fact remains that many leaders in the so-called under-developed areas have been impressed by Soviet claims that they have achieved in one generation what it took us over 100 years to do. We can make a great error in underestimating the industrial potential of the Soviet Union and its satellites. Against that potential is pitted the industry of which the American Society for Quality Control is representative. Thus, in the world today, American industry plays a pivotal role in the preservation of liberty.

Communism and Industrialism

This role will be vastly more important in the future than in the past. Although Marx expected communism to flourish first in highly industrialized societies, communism as we know it is presently asserting itself most effectively in under-industrialized countries. This is a real challenge to the United States because the future of the world depends in a major degree on what happens in those countries that are rapidly emerging from the agricultural into the industrial way of life.

Our economy must not have only the vitality to satisfy the needs of our own people. It must have the further vitality for economic cooperation with nations overseas—with nations which share our aspirations for peace and freedom. Economic strength is a keystone of national defense. Without it, our economic system will be rejected by world opinion. Without it, collective security is impossible.

A major problem of national defense, then, is to build a security system strong enough to deter aggression but not so expensive as to undermine the economic system on which our military might is built. We are paying a high price for security, but this is an investment that is paying generous returns. Sometimes this return on investment is blurred by our irritation with the tax collector. But it is well to recall what we have to show for that investment.

First and foremost, western civilization has been preserved. It may seem commonplace and trite to repeat this obvious and simple fact. However, think back to the period after the war, and you will recall that there were serious doubts that what is now free Europe could survive the barbarism and subversion of communism.

Secondly, as the President said a few months ago: "In Korea and Vietnam, the wars are ended; in Formosa, Guatemala and Iran, the communist threats are blocked; in Trieste, the age-old struggle is resolved; Austria is liberated, the Red Army withdrawn. Germany, at least Western Germany, once again is sovereign and today reinforces European unity." These are accomplishments for which we can be thankful, but we cannot be complacent, for as the President said, "Problems remaining are many and grave because communist imperialism persists in striving to master the world."

Military Capability

What else do we have to show for our investment?

We have a deterrent so devastating that the communists must understand the folly of attacking us. The Army, Navy, and Air Force are armed with weapons that represent the most forward frontiers of science and technology. However, while today we have an arsenal of weapons

*Presented at the Luncheon Session on Monday, May 26, 1958, American Society for Quality Control, Twelfth Annual Convention, The Sheraton Plaza Hotel, Boston, Mass.

sufficient to deter any potential aggressor, it would be rash to assume that this will be necessarily true tomorrow. We are in a "nip and tuck" race with the Soviets who have demonstrated impressive industrial and technological capabilities. Now, for a moment, let's look at the Army, Navy, and Air Force.

Army—The Army has been reorganized along pentomic lines. With great firepower and mobility, the typical infantry division is composed of five highly mobile combat groups organically supported by five batteries of light artillery and one battery of HONEST JOHN rockets. The rockets can be armed with either high explosives or nuclear warheads. In addition to HONEST JOHN rockets, the Army has in operational use NIKE-AJAX and CORPORAL missiles.

The significance of what is happening in the Army can be appreciated when one considers that four battalions of CORPORAL guided missiles have the equivalent firepower of all the field artillery employed by the U. S. Army in World War II, roughly 350 battalions. The impact of military technology on the size and character of military capability is even more forcefully illustrated by the changes which are taking place in the Army air defense units, where missiles are rapidly displacing antiaircraft guns.

Navy—The same general kinds of changes are taking place in the Navy. Three of the new FORRESTAL-class carriers have already joined the fleet. Four more large carriers are under construction, including the first nuclear-powered carrier. In addition to the increased effectiveness of these ships, the combat power of carrier task forces is being greatly improved through the delivery of new high-performance aircraft and through the installation aboard ship of equipment to launch the REGULUS surface-to-surface guided missile.

The submarine force is being greatly strengthened as the new types, both conventional and nuclear-powered, join the fleet. Beginning with the 1957 shipbuilding program, all submarines are being equipped with nuclear power. Three such submarines have already been commissioned. Seventeen are under construction; one more will be started in June, and one shortly afterwards. Seven additional are included in the 1959 budget.

Air Force—The Air Force, too, is going through a major technological transition—changing importantly the composition of the force and achieving greater combat power with fewer military personnel and units.

Today the B-36 is being replaced by the far more capable B-52 which, because of its speed and altitude charactertistics, does not require fighter protection. This has permitted the elimination of the so-called strategic fighter wings from the SAC force. The increased performance of the B-52 is further enhanced by the provision of jet refueling tankers. The number of long-range heavy bombers to be in operation is being increased by fifty percent, even though each B-52 is far more effective than the aircraft it is replacing. (Already, the supersonic B-58 is now being procured as an eventual successor to the B-52.)

In addition, the Air Force is developing a significant strategic missile capability — intermediate range ballistic missiles, such as the THOR, an intercontinental air-breathing missile, the SNARK, and intercontinental ballistic missiles such as the ATLAS and the TITAN.

It is quite evident that our Army, Navy, and Air Force represents a powerful deterrent against aggression. The capability of the equipment that we have provided our fighting forces represents a gilt-edged investment in peace and liberty.

The Price of Defense

But this is a big investment. The FY 1959 budget, for example, represents $41.1 billion in new obligational availability. This compares with $37.2 billion for FY 1958 and $36.7 billion for FY 1957. The relation of performance and cost becomes more evident, for example, when specific aircraft models of the same type are compared. The heavy bomber at the end of World War II was the B-29 which cost about $600,000 each. This was replaced by the B-36 which cost about $4 million each. This aircraft, in turn, is being replaced by the all-jet B-52 intercontinental bomber, costing about $8 million each. Actually each B-52 wing will cost four times as much as a B-36 wing, since the number of bombers in a wing is being increased by 50 percent and each wing is being provided with two jet refueling tankers for every three bombers. The new B-58 supersonic medium bomber, which we plan to buy in production quantities later this year, will cost four or five times more than the current medium jet bomber, the B-47.

Again then, what is the basic problem of the Department of Defense? The answer is quite evident—to capitalize on scientific progress without jeopardizing our economic health.

Management and Defense

My particular part in this Defense effort lies in the management of logistics. In this area, I can tell you that we are making substantial progress in improving logistic management and operations.

Supply and logistics encompasses an extensive variety of functions that can't easily be described in a few words. These functions can probably be most easily understood and interrelated by considering them in the chronological order in which they occur. Establishment of requirements for supplies, facilities and services is the first step in the logistic cycle. After requirements, follow procurement, production, inspection and quality control, distribution, transportation, storage and, when necessary, disposal. This sequence of events is essentially the supply and logistics cycle. I feel we are making significant progress in all aspects of this cycle.

The Subject of Quality

Now, let me touch briefly on the subject of quality. To put this subject into proper focus, there are four background considerations we must keep in mind.

Capability-in-Being—The first consideration is that the survival of the United States depends on capability in existence today. It is obvious that product quality and weapon systems quality are of central importance in this capability. I would like to linger a moment on the subject of capability-in-being, because even though many of us talk about "existent capabilities," sometimes we don't fully appreciate what it means. Let me say what capability-in-being means to me. It means that my continued existence as a human being and as a free man depends on what we as a nation do today. As far as I am concerned, the war of survival is being fought today—now. This war is being fought primarily in the technological arena.

Low-Density High-Value Weapons—The second background consideration pertinent to quality is that we are dealing with low-density, high-value equipment and weapons. In the past, we have won wars because of our ability to mass produce. But our safety now depends on lesser numbers of weapons of overwhelming striking power. These weapons, of necessity, must be of almost perfect quality.

I know that quality control engineers rule out perfection as an impossibility. I accept the fact that perfection is impossible, but whatever the nearest thing to perfection is, that's what we need in the weapons we are developing and producing today.

Incidentally, in considering our position vis-a-vis the Russians, we can't overlook the fact that while we may be able to out-produce them in consumer goods, we are not necessarily superior when it comes to equipment of high precision and complexity, produced in small quantities.

Missiles and Cost of Failure—The third consideration is that our security depends on equipment whose satisfactory performance can only be determined in actual operation. A missile can be fired only once. Either it works or it doesn't. If it doesn't, the penalty is severe—in both dollars and in security.

Research and Development and Production—A fourth consideration is that in new weapons we have a situation where research and development telescope production. We have a kind of concurrent research, development and production. This imposes a terrific burden on everyone, particularly on quality control. This kind of situation is likely to continue for a long time because of the rapid progress being made in missile design and development.

Implications to Quality Control

It seems to me that these considerations suggest some general conclusions that we might draw about quality control. The first is that in the race between us and the Russians, the problem of quality is of prime importance.

But this problem of quality has taken on new dimensions. In the past, quality control has been thought of primarily as control of production processes. For newer weapons, the function of quality control extends beyond production. It encompasses many aspects of product developments, storage, maintenance and performance analysis. This "total" approach to the quality problem has important implications with respect to how we organize for quality, not the least of which is that what we need most is more centralized direction of programs that relate to achieving adequate and economic product quality. Probably the term "quality control" is out of date because it delimits the concept of quality protection to the mere assurance that a product was manufactured to some design requirement. The quality problem is bigger than that. We might speak of "quality management" rather than "quality control." We need new and stronger patterns of management to give us the quality protection we want.

Equally important, we need better coordination between all aspects of quality management, including reliability. We need, for example, a better tie-in among specification writing, qualification testing, acceptance and proof testing, reliability planning, design, development and data feedback. Don't misunderstand me. I am not suggesting that we need bigger quality control empires. I am saying that we need hardheaded scientific management of the total quality problem. At the present time, we have too many loose ends in the quality area. To indicate what I mean, I might ask this question. Are your various reliability, data feedback and inspection programs properly inter-related or is each of these programs a "lone wolf" so to speak? This is the problem management people have to face up to.

Personnel

The second conclusion is that we need more high-caliber technical people in the field of quality control—particularly for planning and management. We still need, however, the skills of conscientious and trained inspectors and technicians to do the hour-to-hour, day-to-day job of quality protection on the factory floor. These inspectors and technicians must have skills unheard of ten years ago.

Cost and Quality Management

Finally, I would suggest that the quality function must be put on a firmer cost accounting basis. Quality control has made tremendous progress. In the future, it can make even faster progress if those responsible for quality management document the relation between the quality effort and production costs. In saying this, I am not concerned merely with saving dollars as dollars. I am concerned with the fact that good quality management involves more than the saving of money. It involves the proper use of expensive engineering and technical talent, materials, and the prevention of failures that could be expensive beyond the measure of money. It serves no purpose to talk about what quality management accomplishes unless those accomplishments can be reasonably substantiated. The only way I know to put quality management on a firm and diciplined footing is to install better accounting procedures.

Progress in the Department of Defense

In the Department of Defense we are making real progress in the field of quality management. But like industry, we have our problems in coordination, personnel, costs, and all the other things that I have just been outlining. It can be said with confidence, however, that quality control operations of the Department of Defense are managed on a sound business-like basis. Three actions by the Department of Defense have contributed to the improvement of our operations:

1. We have established policy that puts responsibility squarely on the producer for quality. Under this policy, the Government merely verifies that the contractor has lived up to his obligation.
2. We have adopted an inspection interchange program by which all inspection in any one plant is accomplished by one service.
3. We have developed new concepts and procedures based on quality control research.

In the future, we will continue to emphasize quality control research, the upgrading of the caliber of personnel, and the more cohesive management of the various aspects of the quality problem.

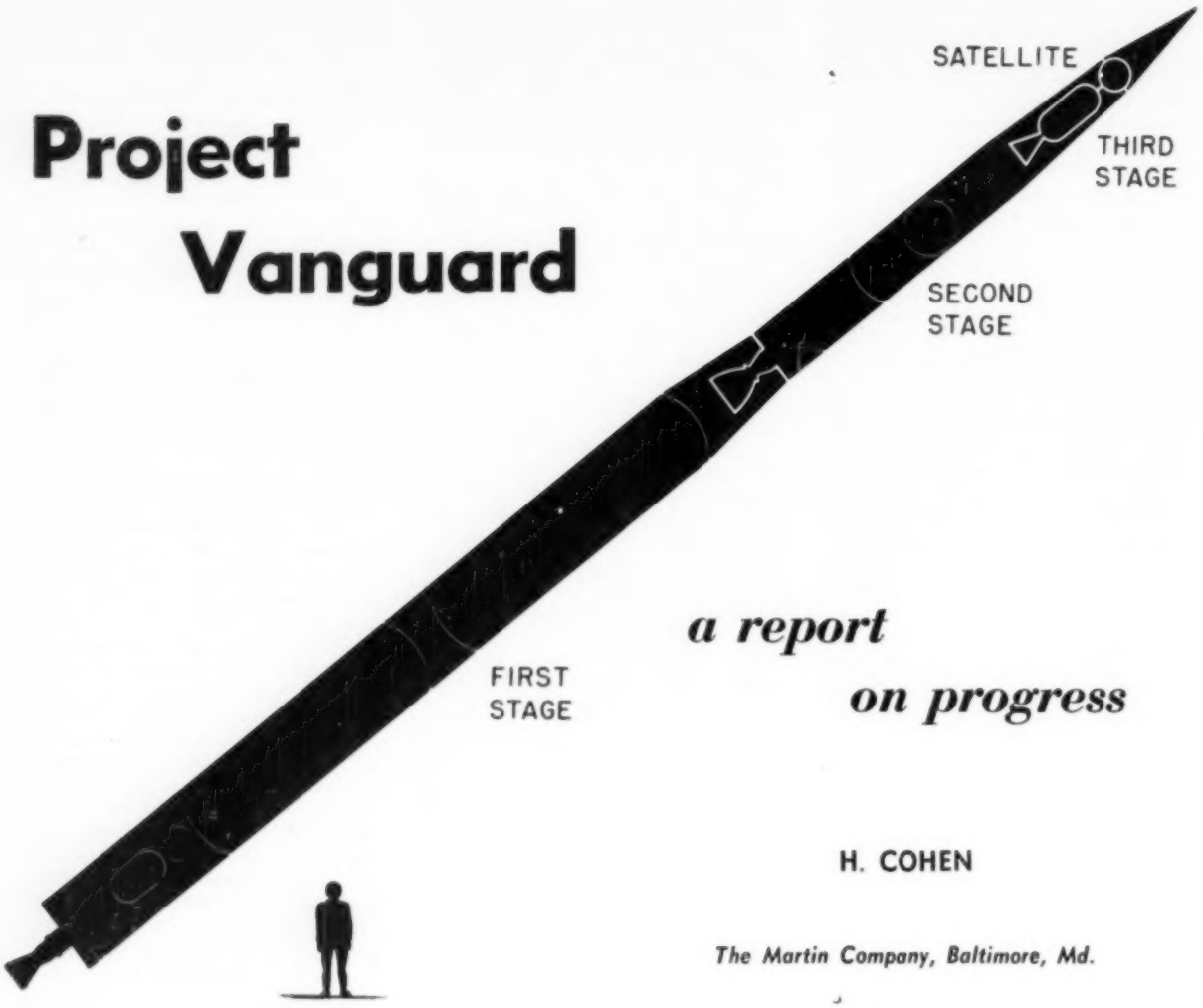
Conclusion

During this talk I have concerned myself with assuring you that, in terms of military capability and good management, you have reason to be satisfied with the investment that you, as taxpayers, have made in the Department of Defense. At the same time, I want to emphasize that neither I nor anyone else in the Department is complacent. We are not unaware of deficiencies that do exist. We are aware of the fact that in gigantic organizations such as the Department of Defense good management must necessarily be dynamic. We have to search continuously for new ideas and better ways of doing things.

While I have emphasized the strength of our Armed Forces, I have been equally concerned with stressing that what is true today is not necessarily true tomorrow. Unless we keep in the front position in the technological race, a race in which quality engineers play a major role, we will have forfeited the future of ourselves and our families.

Project Vanguard

a report on progress



H. COHEN

The Martin Company, Baltimore, Md.

Background

July 1, 1957 marked the beginning of the most intensive period of scientific investigation in history. During the 18 months which are known officially as the International Geophysical Year, scientists from about 60 nations are studying the earth's crust, probing the depths of the sea, and even examining the fringes of space, beyond the earth's atmosphere.

Since World War II, we have already done a bit of space exploration. Sounding rockets like the Martin-built Viking have pierced the atmospheric filter briefly, carrying various types of instrumentation. Vertical rockets can continue to make an important scientific contribution in this manner, and several hundred are being launched during the IGY, but a few moments' thought will reveal why a completely new research device—an artificial earth satellite—is also being used.

The Navy-Martin Viking long held the altitude record for single-stage, unboosted rockets, of 158 miles. But, even during its record flight, it took only about five (5) minutes to reach the peak of its trajectory and another five minutes to fall back to earth. Only a small portion of the ten (10) minute flight was above the atmosphere. If the observation time above the denser atmosphere for all vertical rockets fired through 1956 were added together, they would total approximately only ten (10) hours. Needless to say, they enabled measurements over only a small geographical area as well. Even the recent Pioneer I moon probe stayed up less than 48 hours.

A satellite, on the other hand, could remain in orbit for several months or even years, recording and transmitting information in a wide band around the earth. For this reason, the satellite has been dubbed "The LP" or long-playing rocket.

In July 1955, the president announced that the U.S. had decided to launch earth satellites as part of its effort in the IGY. The original program to launch these satellites has been designated by the Department of Defense as Project Vanguard and is to be accomplished during the IGY. It is sponsored by the National Academy of Sciences in cooperation with the National Science Foundation. Participation by the U.S. Department of Defense is in the form of a joint Army-Navy-Air Force program, under Navy management, to produce and launch the earth satellite. The Chief of Naval Research was designated to manage the overall program for the Navy; and in turn the Naval Research Laboratory was assigned the responsibility for technical management of the program. It has recently been transferred to NASA. Toward this end, The Martin Company was awarded the prime contract for producing the satellite launching vehicle.

Launching Vehicle

Let us briefly examine the Vanguard Launching Vehicle (see Figure), which carries the satellite to a 300 to 400 mile altitude and injects it into orbit at a velocity of about 18,000 miles per hour. It is a 3-Stage Rocket, approximately 72 feet long, with a gross weight of approximately 22,000 pounds.

The first stage is cylindrical, with the same diameter as Viking—45 inches. The rocket engine for this stage is supplied by the General Electric Company. It delivers a thrust of 27,000 pounds at sea level, as compared to the 21,000 pounds delivered by the Viking engine. The propellants are kerosene as fuel and liquid oxygen as oxidizer. A turbo-pump, powered by the decomposition products of hydrogen peroxide, is used to deliver the propellants to the thrust chamber. The relatively low propellant tank pressures required with this turbo-pump configuration are obtained by using helium as a pressurization gas. The same guidance and attitude reference system is used by both first and second stages and is carried in the second stage. The control during powered flight is obtained by gimbaling the entire thrust chamber. Roll control is obtained through the use of jet reactors.

The second stage of the Vanguard vehicle also is cylindrical. The rocket engine and tankage in this stage are supplied by the Aerojet-General Corporation. This engine uses unsymmetrical dimethyl-hydrazine as fuel and white inhibited fuming nitric acid as oxidizer. There is no propellant pump in the second stage engine and consequently, considerably higher propellant tank pressures than in the first stage must be provided. As in the first stage, helium again is used as a pressurization gas.

As mentioned previously, the guidance and attitude reference system for both the first and second steps is located in the second stage. The reference system consists of three (3) integrating rate gyroscopes. The guidance system contains two (2) basic items, a pitch programmer and an integrating linear accelerometer. The pitch programmer provides the vehicle with the necessary in-flight intelligence to allow it to assume the flight trajectory which was chosen and preset prior to launch. Velocity information obtained from the integrating accelerometer allows for in-flight correction of the satellite injection time in the event that the vehicle performance does not match the pre-launch estimates.

The control requirements of the second stage of the vehicle differ from those of the first in that the second stage is not separated from the third immediately after burnout of its propellants. Instead, the second and third stages remain attached during a coasting phase of the flight, and consequently there is a control requirement during both powered and unpowered flight. Pitch/yaw control during powered flight is effected, as in the first stage, by means of gimbaling the thrust chamber. During unpowered flight, jet reactors are used. Roll control during both powered and unpowered flight also is provided by means of jet reactors.

The third stage of the Vanguard vehicle consists of a solid propellant rocket. This rocket is currently being developed by two (2) companies, the Grand Central Rocket Company and the Allegany Ballistics Laboratory. A nose cone shields the satellite from the high temperatures encountered during the vehicle's ascent through the lower atmosphere and is jettisoned during the flight of the second stage. There is no guidance or control system contained in the third stage. Third stage flight stabilization, however, is effected by spinning the rocket just before it is fired. The necessary spin rate will be imparted to the third stage, prior to its separation, through the use of small solid propellant rocket motors attached to a turntable on which the third stage rests. During and after firing, the third stage will continue to spin in its flight.

Flight Trajectory

The emphasis so far has been placed on the vehicle configuration. Now let us examine the flight trajectory that the vehicle will follow in the process of establishing the satellite in orbit.

The first few seconds of flight the trajectory will be vertical. During the remainder of the flight a programmed trajectory will be assumed by the vehicle. Burnout of the first stage will occur at an altitude of about 35 miles and a velocity of about 3700 miles per hour. At this point, the first stage will be separated from the remainder of the vehicle and the second stage ignited. Shortly after this ignition, the nose cone, used to protect the satellite, will be jettisoned. The second stage engine burns out at an altitude of about 130 miles and a velocity of 9000 miles per hour. Unlike the first stage, the second stage is not separated at this time, but instead remains attached during an extended coasting phase. Such an approach is necessary since, as mentioned previously, the third stage contains no guidance or control system and, therefore, is dependent on the second stage to place it in proper position for projection of the satellite into orbit. When the second-third stage combination has coasted to the apogee of the trajectory, an altitude of 300 miles, the velocity will be about 8500 miles per hour. At this point, spin is imparted to the third stage, the second stage is separated, and the third stage ignited. Burnout of the third stage occurs at the required orbital velocity of about 18,000 miles per hour. Shortly after entering its orbit, the satellite will be separated from the expended third stage motor.

Design and Development Program

In order to establish a satellite in orbit, we require accurate control of attitude and of velocity. What assurances do we have that such control is possible? To answer this question, let us examine the scope of the design and development program. The factory testing, and launch-site pre-flight testing which contribute to the build-up of overall reliability of the several systems of the vehicle.

1. Components Reliability

Wherever possible, components for use in the vehicle are selected from lists of standard parts maintained by the Components Application Group. Where non-standard parts have to be used, these are chosen in accordance with previous usage or known history and are qualification tested either by Martin or by the vendor before being flown. Because of the small production quantities involved, components for Vanguard are also functionally checked on a 100 percent basis by Receiving Inspection facilities.

2. Environmental Testing

The Product Utilization Group is responsible for determining the environment in which the components must operate successfully. This is a continuing process since the first estimates are based in part on extrapolated values derived from Viking flights, and these are modified as data becomes available from test vehicle flights.

3. Mock-up Program

In order to check as many vehicle systems as possible, proving out choice of components and engineer-

ing design, an exhaustive program of mock-ups has been utilized prior to the major portions of the flight test program. A few examples are:

(a) Special mock-ups for use in allocating space and determining accessibility;

(b) Third-stage spin and separation dynamic mock-up for use in functional checks of all components of the spin and separation mechanism. Resultant stability studies are useful in trajectory calculations;

(c) Roll mock-ups for first and second stages for use in checking jet reactors used for this purpose.

4. Development Testing

There were a number of such tests, including such items as structural testing of structure elements, tanks, engine supports. Also included were tests of new heat-resistant materials, wind tunnel tests, breadboarding of new electronic circuits, computer studies of systems operation and the subjection of complete systems to full environmental conditions. In addition, complete rockets were subjected to static structural loading, dynamic vibration and shock loading with simulated flight conditions.

5. Sub-Contracted Materials

Some major items of the vehicle are being sub-contracted. In each case, the sub-contractor has been required to submit a detailed qualification test specification and an acceptance test specification. Monitoring of the tests performed as required by these specifications is accomplished by means of Martin source inspectors as well as by military inspection. In addition, both Martin and Military Engineering Personnel monitor the sub-contractor design effort by reviewing drawings and specifications originated by the sub-contractor. All items (exclusive of engines) are again acceptance tested by Receiving Inspection upon receipt by The Martin Company.

6. Factory Bench Testing

All major electrical and electronic building blocks of each system are thoroughly bench checked prior to final installation in rocket. This includes such items as control system servo amplifiers, antennas, autopilot, gyros, telemetering, and range safety equipment, etc.

7. Horizontal Systems Check

All systems are functionally checked with the various stages electrically connected. Flight conditions are simulated to observe parameters of operation.

8. Vertical Systems Check

All systems are functionally checked again with the three (3) stages spliced together with the rocket erected. To accomplish this it was necessary to build a vertical assembly and test facility, 20 by 35 feet and 97 feet high. It is completely enclosed, with heat, light, water, power, etc., to provide for year around operation.

After systems have been individually tested, they are all operated simultaneously to make certain that no interference between systems exists. At this point, the vehicle is disassembled for shipment to the launching site.

9. Quality Control Test Log

Quality Control maintains a vehicle log which is a permanent record of test results, running times, component failures, etc. This log is shipped with the vehicle and additional tests made at launch site are added to it.

10. Launch Site Testing

An exhaustive receiving inspection is performed on the rocket at the launch site to see if damage might have occurred in shipping. This is followed by a complete repetition of component bench checks, horizontal and vertical systems check and a vertical interference and simulated countdown check.

Upon successful completion of a static firing, the final flight firing is attempted.

11. Ground Handling Equipment

All test equipment is designed and qualification tested to withstand atmospheric conditions expected at the launch site. In addition, monitoring provisions are provided so that the functioning of all critical components can be observed right down to the X—0 firing point. Emergency provisions are incorporated so that a flight may be scrubbed at any time if a malfunction occurs.

There are many other operations which contribute to the overall reliability which I can only mention briefly now:

a. Structural design accuracy, made possible by accurate optical alignment tools and by extensive, master gauging program.
b. Quality control stations placed at strategic points in assembly operations;
c. Electronic burn-in and aging programs;
d. Materials testing;
e. IBM auditing of factory and field component failures;
f. Vendor reliability analysis.

Progress of Flight Test Program

Let us review the flight test program to date, to see how the long list of tests has contributed to successful flights.

Test Vehicle Zero

The first test rocket flight, which took place at 0103 on December 8, 1956, was made for the purpose of testing the operation of equipment and instruments to be used in the launching of an earth satellite . . .

After takeoff the Viking rocket ascended vertically a short distance and then was turned slowly toward the horizontal and guided out over the Atlantic Ocean; it reached a peak velocity of 4000 miles per hour and a peak altitude of 125 miles, finally terminating its flight in the ocean about 180 miles from the launching point at the Air Force Missile Test Center, Cape Canaveral, Florida.

. . . the flight . . . did not aim for altitude or range, but was intended as an operational test of the launching facilities and various instruments.

At an altitude of 50 miles during the ascent, a prototype of the satellite radio transmitter, "Minitrack," was ejected from the rocket and tracked in its descent by scientists stationed at the AFMTC.

Test Vehicle One

A high altitude separation test of the launching vehicle for a scientific earth satellite was fired at 1:29 am (EST), May 1, 1957.

. . . A Viking rocket, the 14th and last Viking to be made by The Martin Company of Baltimore, Maryland, was used for (the) first stage. A medium-sized solid propellant rocket, similar to the one being planned for the third stage of the actual satellite launching vehicle, was the second component of (the) test.

The smaller rocket rode aloft in the nose of the larger, liquid propellant, Viking. The experiment checked methods of high altitude separation which are used in satellite launching vehicles.

. . . (The) Viking rose vertically for a short distance, tilted toward the horizon, and shot out over the Atlantic from Cape Canaveral.

By the time the Viking's propellants were exhausted it had reached a peak velocity of approximately 3500 miles per hour. It then coasted to the peak of its trajectory about 120 miles above the ocean, where the smaller rocket was fired in a horizontal direction.

The flight performance of the smaller rocket was monitored electronically by Naval Research Laboratory scientists and AFMTC personnel until it was spent and fell into the water.

Test Vehicle Two

This test vehicle was successfully launched in October 1957. It consisted of a full Vanguard configuration, but carried a dummy 2nd and 3rd stage, thereby providing for a complete test of first stage operation.

Test Vehicle Three

This full Vanguard configuration vehicle was launched in December 1957, but burned on the stand immediately after take-off. Analysis of records indicated needed changes which substantially reduced the probability of this mishap occurring again.

Test Vehicle Three Back-Up

This vehicle was launched in February 1958 and flew successfully for about sixty (60) seconds. At this point, a malfunction in the controls system caused the engine to go hard-over and this in turn made the vehicle veer from its flight path, ending in structural break-up. The malfunction is believed due to a break in the wiring probably caused by the extreme vibration environment encountered in flight. The vibration level was much larger than anticipated and was well beyond the level to which equipment in the area had been qualified. A design improvement consisting of structural beef-up and vibration isolation as well as more rigid control of connector terminations and wiring support resulted from this flight.

Test Vehicle Four

The above difficulties having been corrected, the effort culminated in a completely successful flight on March 17, 1958, which placed a small satellite in a high and very stable orbit. Recent information from Dr. Hagen, NASA, Vanguard Director, indicates that this satellite may stay aloft for 200 years. The solar-powered transmitter is still operating and is expected to continue until it is destroyed by a meteor or other environmental hazards.

Test Vehicle Five

TV-5 was launched on April 28, 1958. The first and second stages burned normally, but the vehicle failed to place a satellite in orbit, however, due to lack of third stage ignition. Preliminary investigation shows that the second stage engine did not shut-down properly. This prevented the post cut-off stabilization and 3rd stage arming sequence from occuring. No further details were yet available at the time of this writing.

Quality Management Blueprint for an R & D Rocket Program

The experience gained on earlier rocket programs is being enhanced by the Vanguard project. The total experience, in retrospect, has been analyzed in an attempt to obtain a list of potential problem areas that warrant concentrated effort by Quality Management on an R & D Rocket Program. The following items resulted from this analysis.

1. Provide a large liaison effort between Quality personnel in the prime contractors facility and in the sub-contractor's plant, particularly where the sub-contractor's effort is in a development stage. The flow of information on difficulties encountered must flow in both directions in an efficient, rapid manner. The marriage problems of complex systems cannot be overemphasized.
2. Preach, teach and rigidly control cleanliness. Rocket propulsion systems are extremely susceptible to contamination by materials not compatible with corrosive fuels as well as to minute foreign particles. It is necessary to imbue every workman with a new approach to his job, to police his own effort constantly and strive for surgically clean work areas and work techniques. The approach must be not merely to clean up the area after the job is done, but to clean the tools and parts before you start, to prevent contaminants from entering while working, remove contaminants while working and then clean-up when completed.
3. Accentuate control of routine items such as soldering and crimping of connectors. Since unknown environmental factors may be encountered, build in a safety factor by having more than adequate wire terminations, cable support, abrasion resistant covering on wire runs, water-proofing of connectors and equipment, etc.
4. Do not overlook ground support equipment. Environmental problems (particularly moisture) must be provided for in the design. A well controlled maintenance and test effort is mandatory to prevent program delays.
5. Provide high level management for field personnel. Since in many instances, a great distance exists between factory and field, field personnel must be capable of making mature, sound, emergency decisions on their own.
6. Plan for a periodic audit of Quality practices by people not normally assigned to a program. This "fresh look" does wonders for prevention of the insidious series of compromises which so frequently occur when schedule starts to unconsciously affect workmanship.
7. Provide a rapid, efficient trouble reporting system with a functioning, authoritative corrective action team. The benefits reaped from well organized failure analysis are enormous. This is particularly necessary where plant and field sites are separated.
8. Increase emphasis on Inspection Planning during early development stages so that well planned Acceptance and Qualification Test requirements can be prepared. This is to be done with top notch Quality Engineering types who are familiar with complex systems requirements.
9. Maintain surveillance in the Quality of Design area by constantly reviewing Engineering specifications and test requirements, checking for compatibility with anticipated environment and end usage.
10. Supply a careful system of control of re-testing made necessary by the avalanche of engineering modifications inherent in an R & D program. This requires screening of each change in the light of "what must be tested over again?"

Add to this list of ten (10) items a crew of inspectors trained in the functioning of complex systems, imbued with the knowledge of the importance of good workmanship and cleanliness and you have materially increased chances for success.

What Does the Air Force Expect of Contractors?*

COLONEL J. G. SCHNEIDER, USAF

Hq Air Materiel Command

Introduction

It is a pleasure to discuss the subject, "What Does the Air Force Expect of Contractors," because it provides an opportunity for me to follow-up on two previous papers presented to the American Society for Quality Control.

In 1951 at Cleveland, I introduced to the Society members their first look at the Air Force's new quality assurance program explained by a new Specification MIL-Q-5923 (USAF). This document was our formal answer to the question, "What does the Air Force expect of contractors?" I might add that the reception afforded my discussion of this new concept, as those of you who were there might remember, was like most things new, not too enthusiastically received.

In Philadelphia in 1953, "The Philosophy Underlying the Specification MIL-Q-5923" was the subject of my talk. I might add that after two years trial, the acceptance was far more favorable than the original introduction, and now upon returning to Quality Control, after four years, the many complimentary things I hear about 5923 from contractors' representatives are most gratifying. In our procurement activities overseas we tell the contractor what we expect of him through the medium of 5923. It may interest you to know that within the few years since it was originated, this specification, or facsimiles thereof, have received wide acceptance and adoption by our military counterparts and industries in many friendly and allied nations throughout the world. It is presently written in the languages of most of the European NATO countries, as well as Great Britain, Canada and Japan, where it is furthering the use of quality control as a management tool.

Top Management and Quality

When speaking of "contractor" I am not only directing my remarks to the quality managers within industry but to top-level management as a whole. I believe we can accept as a basic principle that the quality of any product is largely dependent upon the policy of management, and the effort, interest and emphasis which all of management devotes to the quality and reliability of its products.

By "management" I mean those members of the organization who have responsibility and authority to plan, program, direct and control the industrial effort.

The existence of a quality control organization can be nothing more than a paperwork exercise and so much "window dressing" unless its efforts are firmly backed and supported by all other elements of the organization, and is not being subordinated to any interests which could negate quality.

Effective quality control within the industrial organization becomes a means to an end which can be summed up in terms of a quality product, shipped on schedule, to customer satisfaction and, last but not least, at a reasonable profit. If we accept these principles, then we must look next to the quality control manager and his obligations which can be summed up in a few brief words, "Assure that the quality and reliability are in accord with established standards in the most economical way practicable with a minimum effect on the industrial process." This is an over-simplified statement of a job involving a great multitude of diverse activities which must be planned, coordinated and intermeshed with practically all functions and operations of the whole industrial enterprise.

Quality Control and Reliability

With the spectacular development in technology and the complexity of present day weapons systems, and with particular reference to missiles, which can be "performance tested" only on a sample basis, some rather unique developments have taken place. The emphasis on reliability in the midst of the complexities of unmanned missiles, and space vehicles emphasizes the need for professional quality control engineers, new, better, and less costly inspection techniques, and statistical methods which far outstrip yesterday's activities. We learned in attempting to define reliability* and then to measure it that there is a need for closer relationship between all industrial activities than ever before. Quality and reliability take on new and added significance in the missile era.

Today, quality control and reliability planning must be coincident with the initial proposal stage and simultaneously follow through the development of models and test articles, the prototype and finally the production article. Modern techniques must be incorporated into the plan and properly integrated with the overall engineering, buying, production planning, manufacturing and testing activities. All functions and procedures for controlling quality and reliability must be reduced to written instructions and provisions made for documentation of the quality control effort. The system must be designed to prevent occurrence or recurrence of defects and a means for positive timely corrective action.

*Presented on the program of the 12th Annual Convention, ASQC, Boston, May 1958.

*Reliability is the probability of performing without failure a specified function under given conditions for a specified period of time (as defined by the Advisory Group on Reliability of Electronic Equipment in their report of June 4, 1957, titled *Reliability of Electronic Equipment*).

The Contractor's Scope of Responsibility

The contractor and his quality manager can no longer regard "quality control" as an "in plant" operation. His scope of responsibility and concern extends itself in one direction, into the sources and suppliers of a great variety of critical components and parts, and in the other direction, into the vast complex of the military establishment, the depots, the test centers, the operating commands, and even to bases scattered world-wide.

To further compound the situation, there are many instances where the design contractor will develop, manufacture, test, support, maintain, assist in the training of military personnel, and construct and operate special facilities for a particular weapons system.

Within all these areas of activity, quality control plays a vital part as a key element of top management. In fact, it is management in the broadest and most exacting sense, involving a high level of professional, scientific, technical and managerial skills. Planning the quality control program is as important and precise as all other planning for a given project.

Of significant import is the need for data which give a concise measure of quality control effectiveness and the quality of performance and reliability during production, test and after delivery to the customer. Quality Control should be so positioned within the organization to assure unbiased analysis of data concerning quality and reliability and to redirect action information to other responsible elements of the organization in a fast, positive and complete manner. To be really effective, there must exist a closely integrated relationship among and between all participants in the industrial program. There is an ever increasing need for verifiable evidence of positive control of quality of each item, component and subsystem as it is passed from vendor to subcontractor to prime contractor.

Vendor Rating System

One very effective technique in accomplishing this is the use of the vendor rating system. This involves the use of preaward surveys, as well as a post award running evaluation of vendor's quality effectiveness. It also includes the use of data feedback to the vendor and establishes a factual vendor quality rating which may be utilized for future business. I note that quite a number of contractors are utilizing such a system in some degree. The development of a well planned vendor rating system is not only an effective control device but permits more economic utilization of quality control manpower. This, of course, is in consonance with the Air Force Quality Control Specification 5923. This specification requires the contractor to have an effective and economic quality control system, and does include positive quality assurance of subcontract or vendor parts. The use of a vendor rating system, which requires that evidence of inspection, test and control of quality is furnished by the vendor or subcontractor with his product, can result in minimizing costly visits or assignment to the subcontractor's plant. I firmly believe that the subcontractor should provide proof of quality to the prime just as we look to the prime to show proof of quality to the Government, whenever he tenders materiel for acceptance.

Cost Consciousness

In the short period since returning from overseas, I have attended a number of meetings with various industry associations. In almost every instance, I have been impressed with the fact that cost of quality and cost of quality control are generally interwoven in most presentations. On March 1, the Dayton section of the American Society for Quality Control, staged a very fine conference. The theme of the all-day meeting was, "Quality —Its Measurement and Cost." I notice that industries refinement of most quality control techniques include cost aspects, as well as the primary objective of improving effectiveness. This, I heartily endorse, as a taxpayer and also in my official capacity, because positive cost controls highlight waste and losses due to failure to control quality. When these truths are revealed to management, quality gets back to standard fast.

The Air Force Role

Up to this point we have dwelled upon the contractor's obligation. What then does the Air Force consider as its part in the overall quality control effort? To begin with, by public law, it is our responsibility to assure that only material conforming to contractual requirements is accepted for payment. This again is a very simplified statement of responsibility. Actually, the military part is no less complex and diverse than that outlined for industry. There is, however, a sharp distinction in the comparative extent to which the Air Force duplicates the activities of the contractor in determining acceptability of product. These are not only for economical or practical reasons, but is attributed to a very fundamental concept which became obvious a number of years ago. Very simply stated, quality and reliability must be designed and built into the product. The only way that a contractor can assure that the desired quality is built in is thru very precise step by step examination, testing and control of every important operation in the production process. To accomplish this a substantial number of people possessing a great variety of specialized talents and skills are necessary. From the Air Force point of view then, the assurance by the Government can be achieved if the effectiveness of the contractor's quality control efforts can be measured by a systematic and objective surveillance and audit of the systems, procedures and products, and the validity of quality data produced therefrom properly verified.

Why an Air Force Quality Control Specification

It was this concept which motivated the development of the Air Force Quality Control Specification MIL-Q-5293. This was necessary for two principle reasons. One, all Air Force planning, programming, training and staffing must be based on a single concept, and two, this concept would work only if specific contractual requirements for quality control were established which would be commonly applicable to all contractors. After seven years of successful operation, this decision has proven beyond any question to be a correct one. With the advent of modern weapons systems and missiles and with what we expect to see in the near future, top management must exercise absolute controls over quality and reliability and assure that these essential characteristics are built into the components comprising the weapon system. Evidence that this is accomplished by methods subject to Air Force surveillance or audit facilitates acceptance decision making and results in minimum costs for "Government inspection."

The reason then for a common effort and interest between the industry and military quality control organizations becomes obvious. It explains why the military is concerned with how the quality control manager does his job. It also explains why the military must specify,

in general terms, what is required of a contractor in the way of an acceptable quality control system which assumes equitable treatment to all of its suppliers. It establishes the principle means by which the military discharges its responsibility to accept material that is in compliance with specified quality and reliability requirements of the contract. It protects the citizen, both as a taxpayer and as a competitor for Government business.

We no longer can operate on the old customer-versus-seller concept. The quality control effort within the contractor's facility becomes a matter of joint concern and cooperative relationship. It is through these means and our participation in meetings with industrial organizations, such as American Society for Quality Control, Aircraft Industries Association, Electronic Industries Association and similar agencies, that we can move progressively forward in the development and improvement of these concepts and further cultivate the military-industry team approach. Since the Air Force views these advancements as a furtherance of its own objectives, it has and will continue to lend full support to such efforts.

The Contractor Complies

To get back then to the question, "What does the Air Force expect of contractors?" I must acknowledge that in many respects the expectations have already been realized. We expect, however, that you, who are members of this great organization, which has contributed so much to the quality of military equipment, will accept the challenge before you now and progressively move forward in your efforts to assure even greater effectiveness in controlling quality and reliability, which are so vital to today's high performance aircraft, missiles, satellites and space vehicles.

quality control

Responsibility to Management*

ARTHUR F. VINSON

General Electric Company, New York, N. Y.

In this article, I propose to discuss quality control management's responsibility and its opportunity in the decade ahead. First, perhaps a brief look at General Electric quality control management's responsibility will indicate its importance to us.

GE's Assignment of Responsibility for Quality

Throughout our 78-year history, responsibility for quality control has been assigned in the following ways:

1. To the design engineers, who set up elaborate "checking" systems to classify manufacturing output as "good" or "bad" and to suggest corrective action.
2. To a separate quality organization, which checked the work of both the design engineer and the manufacturing organization. Here, too, the emphasis was on inspection and test—with corrective action largely "after the fact."

Both these plans had a common weakness in the fact that responsibility was not placed directly with the manager who could take immediate corrective or preventive action. From many studies and several trial runs came our present-day "total quality control" concept which places prime responsibility for "making it right the first time" with manufacturing management; responsibility for determining customer quality requirements with marketing management; and responsibility for designing to meet these requirements with design engineering management.

*Presented at the Luncheon Session, All-Day Conference on Quality Control, Rutgers University, Sept. 7, 1957.

The Changing Nature of Manufacturing

Why have we made this important change? Why is quality control a greatly enlarged and vital manufacturing function at General Electric? To answer these questions, we need to look at the changing nature of the manufacturing job itself.

First: The technical complexity of our products is on the increase. In the past, problems in the manufacture of mechanical devices have been solved with a lesser degree of engineering knowledge than is required today. Today's products—involving mechanical, electrical, hydraulic, electronic, and chemical components—call for greater engineering skill in their production. With the advent of atomic devices, there is an even greater demand for engineering knowledge in the manufacturing function on a level that we have not had in the past.

Second: As a result of both this increased product complexity and the progressive trend toward mechanization and automation, we find that the engineering content of the manufacturing job is increasing by leaps and bounds. Today, in several of our large departments, more manufacturing engineers are required to plan and create methods and equipment than are design engineers to create the product itself. The field of manufacturing has always provided an opportunity for the application of sound engineering principles and practice—an opportunity that has not been fully recognized.

Third: The rapid development of new tools and techniques in the manufacturing function has really made a

change in the nature of our business. It has opened many doors that formerly were closed. Now we have: computers; data processing of all kinds; new work simplification methods; operations research; new types of recording instruments; electronic transmission of documents; programmed machines; feedback control—almost working; cold extruding; plastic tooling; atomic tracers for checking machinability and a host of others. The modern manufacturing man truly has a whole new kit of tools for solving the complex problems ahead.

Fourth: These factors certainly spell out the vital need for more engineers in the manufacturing function.

In the middle thirties, for instance, we had only 5 percent of our technical people (graduate engineers) employed in manufacturing. In the postwar period this figure grew to 8 percent, and today we have about 15 percent. Present plans indicate that in another 10 years (by 1966), we may well have as many as 30 percent of our engineers actively participating in the manufacturing phase of our operations.

This may seem surprising, but the same pattern is substantiated by a recent survey of engineering graduates (1950 through 1952) with degrees in mechanical, electrical, and industrial engineering. Of the 2,850 respondents, 950 have already gone into other kinds of work—a one-third loss—leaving a balance of 1,900 who are pursuing technical careers. Of this group, 456—or 24 percent—are engaged in research or other engineering activity, such as the design and operation of power plants. Another 570—or 30 percent—are in the product design engineering function. The balance of 874—or 46 percent—are now engaged in some phase of manufacturing activity—as manufacturing engineers, quality control engineers, production engineers, tool engineers, plant engineers, or in similar positions. There is little doubt that manufacturing technology has a need for and will benefit from this increasing contribution of engineering talent.

The "Curve of Business Maturity"

Another major change that we see is in the importance of the manufacturing job. Our company's leadership reputation, at least up to recent years, has certainly been in the fields of research and engineering. In both functions, historically, there has been a heavy investment in personnel and facilities—as well as in training programs. During this period there were many new products. But, as the majority of our product lines mature, there is a gradual changing importance of manufacturing. We call this the "curve of business maturity."

In the early stages of our product businesses, we have generally been in the position of distinctly selling research and engineering development. This was the important phase of the business, and this is where the dollars needed to be spent. The manufacturing problem was often no more than finding some way of making the product. The quality control problem, similarly, was merely finding some way to check it. This was a very nice situation for manufacturing, because the engineers rarely designed something that couldn't be manufactured at all. Maybe we couldn't make it at a low cost, but we could make it. As a result, we weren't too concerned about manufacturing leadership.

Unfortunately, time and competition have a way of catching up with these situations. Looking at our company today, we come up with only three areas where we are still selling on the basis of research and engineering development alone: atomic energy, guided missiles, and, possibly, industrial diamonds. Jet engines and other related products we exclude because they are now facing rough competitive manufacturing problems. For the overwhelming balance of our products, accordingly, competitive leadership and profits depend more and more upon the ability of a business to get engineered productivity—the lowest manufacturing cost. To my mind, this is the one big problem in most of our businesses—a problem whose solution calls for an intelligent investment in men and manufacturing development—and one that led us to establish total quality control as a major new function with completely changed scope.

Total Quality Control

The new function of quality control engineering integrates the many quality elements in the manufacturing cycle from product planning through shipment. Total quality control emphasizes the technical pre-planning of the product quality control system. It makes possible the emphasis on operator quality responsibility to "make it right the first time," supported by light but positive process control inspection.

Total quality control is inherently more reliable and less costly to operate than the fragmentary inspection or statistical quality controls often considered modern by many managements today.

Our program also charges quality control management with responsibility for the mechanical aspects of quality control—for the optimum mechanization of inspection and test equipment. This equipment, incidentally, accounts for about 20 cents of each equipment dollar, and its share is growing as we mechanize and automate our shops.

Quality Problems and Automation

In the decade ahead, what will be the needs in quality control, particularly as we move toward automation? It is the belief of some that automation will eliminate the need for quality control. Our studies, to the contrary, show that with automation we shall have more quality problems instead of fewer; we shall have even more intense upward pressures on quality costs than exist today; we shall have a much greater rather than a lesser need for high-level quality control work.

Let me illustrate these points with a small example drawn from our Meter Department's automation program for watt-hour meter assembly.

For most hand assembly lines, a 1 percent reject quality level for hardware is an unusually tight goal. But let's see what such a 1 percent level means for one of the department's automated subassembly operations—the magnetic bearing support.

The operation requires use of two thin washers per subassembly, to be used as magnet spacers; 720 of the subassemblies are produced per hour, thus using 1,440 washers. If 1 percent of the 1,440 washers have a small burr or a slightly rounded edge, there will, on the average, be 14 machine stoppages per hour—one every four minutes—due to washers jamming the track feeding the machine. Thus, with a very tight 1 percent reject level for hardware, the automated equipment will be down more than it is in operation. Obviously, such a 1 percent reject level doesn't begin to be good enough for meter automation.

When we add to this meter example a liberal sprinkling of other examples with much greater quality complexities, we find emerging the true nature of the quality problem under automation. It is that, unless the "make-it-right-the-first-time" total quality control planning principle is really made to work, there will be

no automatic production. Machine down time will see to that. Compared with today's hand operations, the automation of the future will require that quality control engineering develop far better procedures for determining the quality-ability of new designs prior to the start of production; it will require that process control engineering build far tighter controls over incoming material quality and over in-process quality; it will require that the quality control equipment development laboratories create far more effective inspection, test measuring, and feedback control devices; therefore, it will require the development and use of far higher levels of quality control technology.

Conclusion

Before concluding, may I suggest that perhaps we have all underestimated the value of quality control in mechanical manufacturing plants. Several recent studies in our plants and others indicate that a completely effective total quality control program alone could double profits—or, if you wish, could substantially reduce prices and broaden markets, or accomplish some of both. Quality control to us, therefore, is not just a profession, not a promotional effect, not just a new function, not alone an engineering and scientific challenge. It is a down-to-earth, essential business opportunity.

In conclusion, I predict that the men in quality control have a more complex future ahead—one of statistical, mechanical, electrical, electronic, chemical, and perhaps even atomic control of this increasingly important business element. In their hands is the responsibility for a large part of our industrial future, for customers are demanding higher and higher quality, and we must create economic ways of meeting this quality need to assure continued customer acceptance of our products.

Process Control *in a job shop*

FRANK CAPLAN, JR.

Westinghouse Electric Corporation, Blairsville, Pa.

When statistical quality control techniques were first developed, it was felt by many that these methods applied specifically to large industries which mass-produced great volumes of identical items. A number of years later, medium-sized and even small companies producing some volume of parts, supposedly identical, were making use of statistical techniques to good advantage. Applications in the job-shop, however, have not received as much attention or publicity, relatively speaking, as they deserve.

The system reported in this article was devised for a development shop where the great bulk of material produced fell in quantities of one to twenty. The parts ranged in size from small gears to large forgings and castings. Types of operations included lathe, drilling, grinding, vertical turret lathe, horizontal boring mill, and sheet metal fabrication, as well as hand rework operations. Although there were some reasonably large volume items produced in the shop, these were not covered by this system but a different one was developed for use in those areas.

INSPECTION DAILY TOTAL

MACHINE NUMBER	PARTS PROCESSED BY FIRST SHIFT		SECOND SHIFT		THIRD SHIFT	
	INSP. POINTS	DEVIATIONS	INSP. POINTS	DEVIATIONS	INSP. POINTS	DEVIATIONS
326			97	2		
417			116	14		
83			17	0		
205			263	1		
641			121	4		

AREA Lathe

J. Jones INSPECTOR 2 SHIFT 3/2/56 DATE

Figure 1

MACHINE NUMBER	DATE	PS	1st SHIFT 3/1	1st SHIFT 3/2	2nd SHIFT 3/1	2nd SHIFT 3/2	3rd SHIFT 3/1	3rd SHIFT 3/2	3/15
326	NO. DEFECTS	1.4	1	0	0	2	1	—	
	NO. INSPECTIONS		49	101	86	97	51	—	
	TOTAL DEFECTS		1	1	0	2	1	1	
	TOTAL INSPECTIONS		49	150	86	183	51	51	
417	NO. DEFECTS	2.3	3	0	5	(14)	(9)	1	
	NO. INSPECTIONS		84	89	67	116	101	28	
	TOTAL DEFECTS		3	3	5	(19)	(8)	(9)	
	TOTAL INSPECTIONS		84	173	67	183	101	129	
83	NO. DEFECTS	6.9	1	0	1	0	0	0	
	NO. INSPECTIONS		9	19	14	17	13	8	
	TOTAL DEFECTS		1	1	1	1	0	0	
	TOTAL INSPECTIONS		9	28	14	31	13	21	
205	NO. DEFECTS	2.1	3	3	4	1	0	—	
	NO. INSPECTIONS		147	188	214	261	204	—	
	TOTAL DEFECTS		3	6	4	5	0	0	
	TOTAL INSPECTIONS		147	335	214	477	204	204	
641	NO. DEFECTS	.05	0	(0)	0	(4)	0	4	
	NO. INSPECTIONS		178	178	88	121	19	162	
	TOTAL DEFECTS		0	1	0	(4)	0	4	
	TOTAL INSPECTIONS		178	356	88	209	19	181	

Figure 2

Since the above-listed operations cover the bulk of machining practice in American job-shops, I believe that we can now throw away the attitude "it's all right for Joe Blow, but it won't work in my shop," and see whether this technique actually can be applied generally.

The first step in establishing the system was to develop and adopt two points of philosophy. The first all-important point was that the operators were not producing parts as such but were producing inspection points. This immediately translated to a common level all operations on all machines and handwork. It didn't matter whether the inspection point was a diameter or the removal of burrs around a drilled hole. In either case, they could be compared directly as representative of whether or not the machine, the man, or the method was capable of doing the work required.

The second important point of philosophy was that we were not in the least bit concerned with punishing people who produced defective inspection points. We wanted to determine only what the cause was and correct it so that defective parts would not be produced in the future. Therefore, a basic part of the system was the requirement that the foreman investigate and report on each out-of-control point.

Each inspector carried a notebook whose pages were made up like Fig. 1. In this, he recorded the machine number, how many points he had inspected during the shift, the proper shift to be credited with these points, and the number of deviating points he had found. He then signed the pages and turned them in to his foreman. The following morning, the sheets were collected by a representative of the Quality Control Department and tabulated on floor charts similar to Fig. 2. These charts were posted on large easels in each department and carried the information for a two-week period. They showed the number of defects found and the number of inspection points examined for each shift, as well as the cumulative defects and inspection points over the period of the chart. These were charted by shift for each machine in the area—in Rework by the type of defect. Since the process average had been calculated in the previous period, whether or not the indicated results were

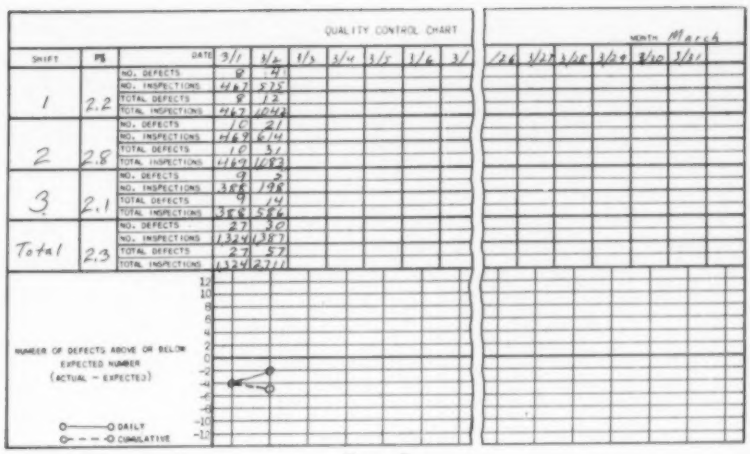


Figure 3

FOREMAN'S DEVIATION REPORT

AREA	MACHINE OR OPERATION NUMBER	DATE	SHIFT	NO. OF DEVIATIONS
Lathe	641	3/2/56	2	4

PART NUMBER AND NAME: 3048627 Shaft

OPERATOR ERROR		NON-OPERATOR ERROR	
CAUSE OF DEFECT	X	CAUSE OF DEFECT	X
FAULTY MACHINE OPERATION		PRIOR OPERATION	
MEASUREMENT ERROR		MACHINE	
POOR SET-UP		PLANNING	
MISREAD PRINT		ENGINEERING	
WRONG TOOL	X	HEAT TREAT	
OTHER (SPECIFY)		TOOLING	X
		MATERIAL	
OPERATOR: 114		OTHER (SPECIFY)	
SHIFT: 2		SPECIFIC CAUSE OF DEFECT: (I.E. GAGE DESIGN, COMPUTATION OF STACK-UP IN PLANNING, ETC.) Wrong tool provided	

COMMENTS: Operator asked for special tool at tool crib — wrong one issued - he didn't check it, but used it.

ACTION TAKEN TO PREVENT RECURRENCE: Discussed with operators, tool room supervisors, and tool room attendants.

DISPOSITION OF PART(S): Scrap.

FOREMAN AND SHIFT AT DEVIATION LOCATION	FOREMAN AND SHIFT RESPONSIBLE	GENERAL FOREMAN'S APPROVAL
J. Severs 2-Lathe	H. Brown - 2 Ford	P. R. Sloan

Figure 4

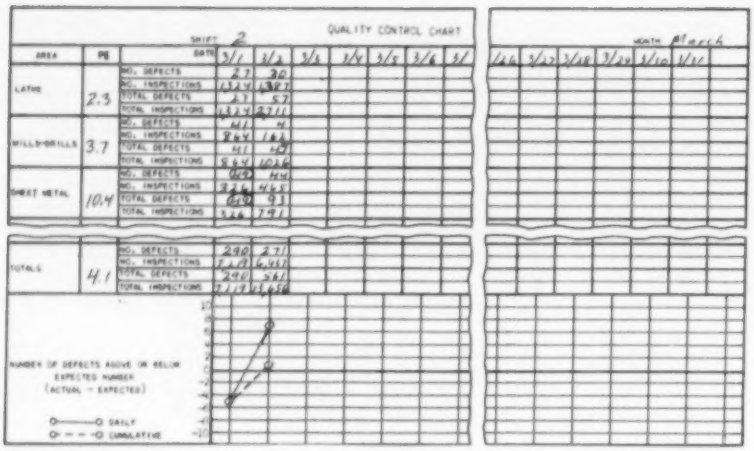
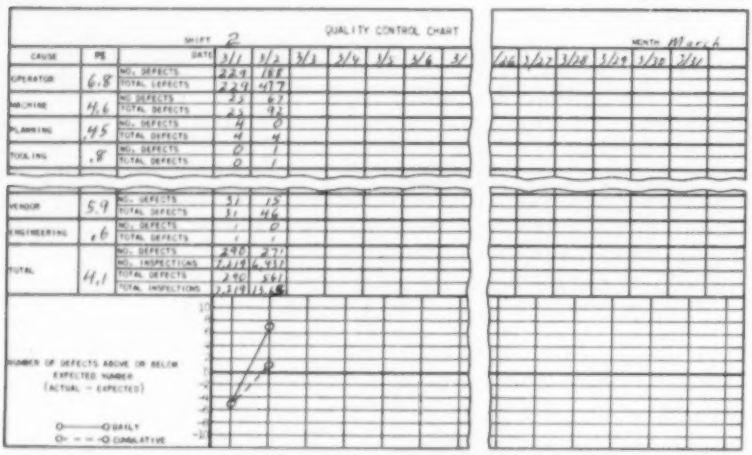


Figure 5—above

Figure 6—below



out-of-control could be determined by reference to a number defective table which sets up control limits for a wide range of sample size and fraction defective. Numbers defective on the high side of the allowable value were circled in red; those below the low limit were indicated in green; and the charts presented a very clear picture of the quality effort in the department. After posting these results, the Quality Control representative posted charts similar to Fig. 3 in the office of each General Foreman showing the results of the previous day's activities for each of his foremen.

Similar charts recapping the operations of each General Foreman were posted in the office of the Superintendent.

This provided for a continuing emphasis by each level of supervision on quality problems. In fact, as a direct result of this system, it became imperative for the foreman to investigate every deviation immediately in order to be able to answer satisfactorily questions which he knew would be forthcoming. In order to aid him in this area, the inspectors were instructed to notify the foreman as soon as any defective material was found rather than waiting for the normal time lag when the information would be posted on the floor chart. The foreman then investigated each such incident and filled out the Foreman's Deviation Report (Fig. 4). In this, he identified the difficulty and then attributed the defect to the responsible area and to either operator or non-operator error. If he attributed the defect to causes outside his own department, he was required to obtain the signed concurrence of the person in charge of that department. This report was then signed off by the General Foreman who would also adjudicate any disagreements that arose. An important portion of the form is a section devoted to action taken to prevent recurrence. Follow up on this by the quality organization contributed considerably to a sizable over-all reduction in the defective material produced.

Quality control reports were issued monthly as shown in Figures 5 and 6. These showed the departmental standings and also the defect figures chargeable to various causes. By this means, quality improvement effort could be concentrated in areas where maximum returns could be obtained.

In the actual installation of the system, each department was handled in turn and meetings were held with every foreman, appropriate union representatives, and the inspectors to make sure everyone was fully aware of the program and its goals. Although there was naturally a certain amount of distrust initially, as the system operated and more and more departments were exposed to it, a spirit of cooperation developed which contributed significantly to the success of the operation.

The experience described above covers a system which is applicable to almost any job-shop in the country. It provides a reasonably simple and inexpensive statistical control chart system for considering, as one, things that previously were considered widely separate and distinct operations. It is an invaluable index for demonstrating whether or not your job-shop has the basic attitude of "making it right the first time" and provides a technique for reaching and holding that very desirable goal.

Chemical Division News

The Second Annual Conference of the Chemical Division held at Buffalo on Oct. 2-3 was an outstanding success. Registration reached the 260 mark. Although relatively small, the conference was self-supporting and exhibits a strong growth over last year's conference. The Division congratulates the Buffalo and Rochester sections for the excellent support provided.

At the council meeting following the conference, $5000 was appropriated to ASQC for establishing the new journal *Technometrics* in cooperation with the American Statistical Association. Plans were laid for the 3rd Annual Conference to be held Sept. 24-25, 1959, under the chairmanship of J. H. Moger. It will be hosted by the South Texas section at Houston.

13TH ANNUAL CONVENTION AND NATIONAL ALL-INDUSTRY QUALITY CONTROL & PRODUCTION EXPOSITION
CLEVELAND PUBLIC AUDITORIUM
MAY 25-27, 1959

One of the largest conventions of the year to be held in Cleveland will be the All-Industry Quality Control and Production Exposition and Thirteenth Annual Convention sponsored by the American Society for Quality Control to be staged in the huge Public Hall, May 25-27, 1959.

Announcement of plans for the coming three-day convention and exposition were made by Wade R. Weaver of the Republic Steel Corp., who is general chairman of the convention committee. Mr. Weaver predicts an attendance of over 3000 at the springtime conclave.

With the theme of "Q To Quality" more than 75 authorative technical papers will be presented at the convention by some of the world's leading experts in the quality control field. The papers are geared to achieving higher quality, more production in shorter time and lower costs, a key objective in every phase of American business and industry.

The technical sessions will be devoted to such fields as chemical, automotive, electronics, textile, metals, aircraft, brewing, armed services, and education. Other sessions will deal with manufacturing and assembly, administrative, standards, reliability, operations research, technical and general interest subjects.

The exposition this year in Public Hall will include a large number of exhibits presenting the latest developments in the tools, procedures, methods and practical applications of quality control. They will be offered by the nation's leading firms specializing in equipment, methods and services of this type.

A brand new "staggered" meeting plan will be in effect for the Cleveland convention. The various fields of interest will present one-hour long technical sessions starting at 9 am, 9:30 am, 10 am, and 10:30 am. This will provide exhibitors a steady flow of audience and eliminate peaks and surges that make it difficult for both exhibitor and attendee.

Again this year a big plus audience for the convention and exposition comes from the U.S. Air Force, Navy and Army personnel, both military and civilian, who will have top production experts on hand to learn how to insure America's mighty defense machine is of the best possible quality.

With the meeting in the heart of the big midwest "Ruhr" and industrial center, many exciting and inspiring plant tours are being planned. These trips will afford an opportunity to see quality control in action, for it is here where more than 25 percent of the nation's jet aircraft and missile parts are produced. Here, also, is where the largest automotive concerns are locating major motor and assembly plants and where thousands of small industries create a beehive of suppliers.

The Cleveland host committee includes: Mr. Weaver, as chairman; John F. Occasione, American Steel & Wire Co., vice chairman; Charles H. Joseph, World Publishing Co., in charge of publicity; W. H. Coughlin, Thompson Products Co. and Charles E. Wolf, Dobeckmun Company, program; Charles R. Kendel of The Lamson & Sessions Co., exhibits; Paul W. Kuckuck, The Weatherhead Co. and Howard O. Schmidt, Aluminum Co. of America, arrangements; Fred C. Leone, Case Institute of Technology, book booth; Ray E. Marks, Ford Motor Company and Sam H. Troxel, Ohio Bell Telephone Co., reception; and Stephen C. Bates, Bell Telephone Laboratories, advisory.

section briefs

ALLENTOWN-BETHLEHEM . . . The 1958-59 program officially began on Sept. 10 at a dinner meeting at the Hotel Traylor. We were very fortunate to hear O. H. Somers of Raytheon discuss "Applied imagination in QC." Mr. Somers gave a brief outline of Raytheon's field of operations, and then presented an extremely interesting and informative talk on using statistics and "Cloud 9" solutions to problems that cannot be solved through standard engineering approaches. He also discussed a method of making a process capability study that will save a great deal of time and money and, at the same time, will give practical tolerances. This technique can be used to show persons and departments just what a process capability is and will eliminate a great deal of misunderstanding. The question and answer session that followed the talk indicated the interest Mr. Somers generated by this unique presentation and excellent material coverage.

BALTIMORE . . . The first of the fall meetings was an outstanding success. Ervin Taylor of the Martin Company presented an enlightening talk on a new concept in sampling inspection called 'discovery sampling." This utilizes the frequency of occurrence of defective lots of material to reduce the size of the inspection samples, which are greater in conventional sampling plans. He explained that inspection of a smaller sample size will give equal assurance of quality as that obtained with a larger sample. The lively and stimulating discussion, following his talk, was indicative of the interest he generated.

Prior to this meeting, the first of seven basic QC training sessions was presented by section vice chairman Frank Cullen. This first session, attended by 34 persons, was favorably received. It is anticipated that with the interest expressed, this group will be a nucleus for additional members in the Society.

BATTLE CREEK-KALAMAZOO . . . "Know your ASQC" was the title of a panel discussion conducted by section officers and committee chairmen at the Oct. 17 meeting held at the Fuller Mfg. Co. in Kalamazoo. Coffee was served following the discussion.

A "problem night" meeting will be held on Dec. 12 at the Sutherland Paper Co., Kalamazoo. A panel consisting of area quality control managers will consider all types of problems.

BOSTON . . . The executive committee held their monthly meeting on Sept. 4. The new program was presented. It includes three plant tours, a social evening, the Annual Outing, and a joint panel discussion with the Industrial Engineering Society in addition to the regularly scheduled lectures.

The section will again sponsor four educational lecture series as it did in 1957-58.

Section president Miss Dorathea Looney and past president Harry Duane presented a gift of $250 to Northeastern University and a gift of texts to Wentworth Institute. The gifts, in behalf of the section, are intended for the advancement of quality control in and around the Boston area.

BUFFALO . . . Three courses in statistics and QC are being co-sponsored by the section and local educational institutions. All three courses will be taught by section members.

Course	Place	Instructor
Basic QC	Hutchinson Technical High School	Walter Kubisty
Statistical QC	University of Buffalo	Sigmund P. Zobel
Elementary Industrial Statistics	D'Youville College	Joseph L. Giocle

BUZZARDS BAY . . . Eighteen members and guests representing industries in New Bedford, Fall River, Taunton, and Providence attended the Sept. 9 meeting held in the Conference Room of the Continental Screw Co. G. A. Chenoweth, supervisor of factory training for the Norton Co. of Worcester, was main speaker. He was assisted by F. B. Olson, Norton QC engineer, in an illustrated lecture entitled "Aids in gaining acceptance of QC suggestions." Their three hour talk was based on excerpts from a 22 full-day course taught at the Norton Co. on the art of salesmanship and fundamentals of management. Techniques for overcoming conflicts, disagreements, and negative reactions in business relationships were analyzed by the speakers. A lively question period concluded their presentation. Kenneth Chace of Berkshire-Hathaway, Inc. and Edward S. Rudnick, co-chairmen, arranged the program. Hans E. Picard of the Aerovox Corp., section chairman, presided.

CHARLESTON . . . Kanawha Valley's management heard a first hand report of "Quality control—its role in management" when O. E. Johnson, vice president of Bristol-Myers Products Division, was guest speaker at a recent meeting. The program—primarily for the managers, superintendents, and executives who make West Virginia and Charleston the largest chemical complex in the U. S.—was attended by some two hundred leaders.

The section was proud to add this dinner program to its fine list of accomplishments since receiving its charter in 1956.

CHATTANOOGA . . . The section began the 1958-59 season in September with a very informative talk by Frank Caplan, Jr., Westinghouse Electric Corp., Atomic Fuel Dept., on "Intramural quality relations."

CHICAGO . . . The first general meeting of the year was held on Sept. 17 at the Furniture Club of America. Dr. Horace C. Andrews of Swift & Co. was the afternoon speaker. His subject was "Increasing a process yield." The talk centered around a revolutionary approach to process improvement particularly valuable when business is slow and reduced costs are a must. Dr. Julian H. Toulouse, Owens-Illinois Glass Co. of Toledo, discussed "Training in QC." His talk followed a social hour and dinner.

The first session of the new advanced educational series started on Sept. 16 at Navy Pier, Room 65. About 25 people attended. Dr. Marjorie L. Sutherland, chairman, stressed the new approach to statistical training called "PEG-Board" statistics which will be used in this advanced series.

CINCINNATI . . . At the September meeting, QC consultant Bonnie Small of Western Electric Corp. spoke on the subject of a "Practical training program for QC people." Her presentation on unique methods and examples of installing QC at various levels in an organization was praiseworthy and demonstrated once again that here was a speaker well known and appreciated throughout the country.

Earlier in the evening the guest dinner speaker, Glen Mitchell, manager of personnel training and development for the Kroger Co., spoke on "Brainstorming." The techniques and examples used in his talk amply demonstrated the power of creative imagination and its application. His talk made a deep and lasting impression on his audience.

Guest speaker at the Dec. 10 meeting will be Dr. David R. Peryam of the Quartermaster Food and Container Institute. His subject will be "The use of sensory testing in flavor QC."

CLEVELAND . . . On Sept. 12 the section opened its season with a most practical talk by Brother Richard Wallen of Western Reserve University on the subject of "Human relations in QC." If the principles presented are followed by members of the section, each one will get along better with both the production and quality sides of their company.

COLUMBUS . . . The first fall meeting of the section was held Sept. 17 at the Kimball Glass Co. A very fine talk was given by William Brown on "Control charts in a plating operation." There was considerable interest shown during a question and answer period after the talk.

On Dec. 11 the section will hold a joint meeting with ASME at the Jeffrey Mfg. Co. The DoALL Co. has prepared an interesting talk and display on "The story of the cutting edge" which portrays man's improvement in developing cutting tools.

CORNING-ELMIRA . . . The section would like to thank Willard Allphin, illumination research engineer at Sylvania Electric, Salem, Mass., for his enlightening talk at our initial meeting.

One of the hi-lights of the year promises to be the Dec. 9 plant tour of the newly constructed Corning Glass Works plant at Big Flats. This plant, the largest of its kind in the world, primarily manufactures laboratory glassware and features a unique solution to a difficult material handling problem. The tour should be of great interest to all who attend.

CUMBERLAND . . . Dorian Shainin of Rath & Strong of Boston was the speaker at the Sept. 4 meeting. Mr. Shainin's topic of "How management uses QC to reduce operating

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10—4A	Shop Camera	10 Curies Co 60	.125 x .250"
10—5A	Puff Camera	30 Curies Ir 192	.062 x .176"
10—5B	Puff Camera	100 Curies Ir 192	.187 x .280"
10—5C	Puff Camera	2 Curies Co 60	.125 x .125"
10—5D	Puff Camera	10 Curies Co 60	.125 x .250"

		BEST RANGE	
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10—2	45 lbs.	⅜"-2½"	1"-2½"
10—4	340 lbs.	¾"-6"	over 3½"
10—4A	850 lbs.	¾"-6"	over 3½"
10—5A	44 lbs.	⅜"-2½"	1"-2½"
10—5B	180 lbs.	⅜"-2½"	1"-2½"
10—5C	390 lbs.	¾"-6"	over 3½"
10—5D	900 lbs.	¾"-6"	over 3½"

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PRINCETON DIVISION

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costs'' was of interest to all. This was the first event of 1958-59 and a good attendance was noted for the dinner and the meeting.

DALLAS-FORT WORTH . . . Thirty-one members and 12 guests enjoyed an extremely interesting and thought-provoking talk by C. T. (Tiny) Shewell, district 14 director, at the Sept. 11 meeting. His talk concerned ''Your Society and you.'' Mr. Shewell dealt with what we, as members, could do for the Society, and what the Society could do for us as individuals as well as a section. Though he cited conditions which, in his opinion, could and should be corrected, his prime objective seemed to be to provoke each member into a more positive participation in the activities and operation of the Society, both locally and nationally. He particularly stressed the importance of each member exercising his democratic right and obligation to vote at every opportunity.

The section's eight-week course on basic SQC will close on Dec. 2.

The Dec. 11 meeting will be a joint engineer's night and a tour of Texas Instrument's beautiful new plant at 13500 North Central Expressway, Dallas. This will be an excellent opportunity for members and their guests to visit T.I.

DAYTON . . . On Sept. 4 the first section meeting was held at the National Cash Register auditorium. The speaker was William E. Smith, foreman of the SQC department of NCR. Mr. Smith spoke on the subject of ''Practical QC at NCR.''

George Garrett, Aeroproducts Operations Div., GMC, has been appointed chairman of the education committee and has enrolled 12 students in the introductory SQC class. The class is under the direction of John M. Stanch, QC engineer of Leland Electric Aircraft Products Plant. Plans are now being formulated to hold a class in advanced QC techniques to be given later in the season.

DELAWARE . . . On Dec. 2 the section will hold its third meeting of the season. The program will highlight ''Management'' which is one of the areas to be covered during the season. Speakers for this meeting include Paul C. Clifford of Montclair State Teachers College and Gordon Fromm of International Latex Corp.

R. G. Mitchell, International Latex Corp., will speak at the clinic session. He will present a case study on ''Attribute defect prevention through scatter diagram analysis.''

DENVER . . . On Sept. 11, fifty members and guests enjoyed an excellent dinner in the roof garden cafeteria of the Gates Rubber Co. Charles Weller, QC head of the company, arranged guided tours through the tire and V-belt manufacturing and inspection departments. Of particular interest was the application of Beta Ray gauges automatically controlling the square yard weights of materials fabricated into tire and belt stock.

At the Oct. 9 dinner meeting, held at the Boulder Country Club, J. Posakony of the Automation Instruments Co. presented ''Sonic testing.''

ERIE . . . The first meeting of the year was held on Sept. 24. The evening was planned to present a discussion on both job-shop QC problems and also mass-production QC problems. It began with a problem discussion period, led by R. Herrick of Erie Resistor, on a case problem from a mass production type of company. After dinner, Mr. Green of the General Electric Non-ferrous Foundry presented a talk on ''QC in a non-ferrous foundry'' to some 30 people.

EVANSVILLE-OWENSBORO . . . The section had a very enjoyable evening at the Kokics Restaurant on Sept. 16. The speaker for the evening was David G. Browne, an executive director of ASQC and vice president of the Broderick Co., Muncie, Ind. Mr. Browne's subject was ''Some philosophical implications of quality control.''

The Dec. 16 meeting will consist of a tour of the Potter and Brumfield plant in Princeton, Ind. The tour will be conducted by Fred A. Wilhite, QC manager for the company. Mr. Wilhite is also section vice chairman.

GREATER MUSKEGON . . . Thirty-five persons were present at the Sept. 11 meeting held at Bill Stern's Steak House to hear Dr. Andrew Luff of Western Michigan University. His discourse on the historical background of QC and the need for training technicians in the future was most interesting. Mr. Luff mentioned the Patnum Report and its predictions for the future.

The Dec. 11 meeting will be held at Cumerford's Restaurant in Holland. An out-of-town meeting has been arranged due to a sizeable membership from industries outside of Muskegon. Lewis Brunner of the Holland Division of GE will be in charge of the meeting. Dr. A. V. Feigenbaum will be guest speaker for the evening and will discuss the various phases of ''QC at General Electric.''

HAMILTON . . . S. P. Zobel of the Carborundum Co., Niagara Falls, was the speaker at our first meeting of the 1958-59 season. The subject ''Training for QC'' was ably covered

List of Short Courses in Quality Control

Usual Time Course is Held	*Type of Course*	*Where Held*	*Course Director*
February	Basic	University of Illinois, Urbana, Ill.	J. A. Henry
February	Basic	Michigan State, Lansing, Mich.	W. D. Baten
June 8-19, 1959	Basic	Marquette University, Milwaukee, Wis.	Gayle McElrath
June	Advanced	Purdue University, Lafayette, Ind.	I. W. Burr
June	Basic (Chem. Ind.)	Rochester Institute of Technology, Rochester, N. Y.	R. D. Pease
July	Basic	TAPPI Statistics Conference	M. S. Renner
July	Advanced	University of Oklahoma, Norman, Okla.	R. L. Huntington
August	Basic	University of Michigan, Ann Arbor, Mich.	C. C. Craig
August	Basic	U.C.L.A., Los Angeles, Calif.	Edward Coleman
August	Advanced	U.C.L.A., Los Angeles, Calif.	Edward Coleman
Aug.-Sept.	Basic	University of Connecticut, Storrs, Conn.	R. M. Story
September	Basic	Washington University, St. Louis, Mo.	D. J. Kaufman
September	Advanced	Rutgers University, New Brunswick, N. J.	M. E. Wescott, E. R. Ott
September	Basic	University of Mississippi, Oxford, Miss.	Gayle McElrath
October	Basic	State University of Iowa, Iowa City, Iowa	L. A. Knowler
October	Basic (Graphic Arts)	Rochester Institute of Technology, Rochester, N. Y.	R. D. Pease

Correction Notice

Several typographical errors occurred in a recent article which appeared in *Industrial Quality Control*. ("A Guide to the Use of Statistics in the Chemical Industry" by Richard S. Bingham, Vol. XV, No. 3, September 1958.)

On page 16, the second footnote in the first column should read:

*Box, G. E. P., "Multi-factor Designs of First Order," *Biometrika*, Vol. 39, No. 49, (1952) describes a procedure of angular randomization for eliminating trends of extraneous effects.

On page 17, Table V, the heading in the first column of the Table should read:

Number of Analyses per Standardization (n)

Our apologies are extended to Mr. Bingham and our readers.

ASQC COMMITTEE ON PROFESSIONALISM

The Allentown (Pa.) plant of the Western Electric Company was the site of the October 1 meeting of the Society's Committee on Professionalism. Committee members are (clockwise from left): P. A. Robert, W. H. Lewis, D. A. Hill, Robert Schin, C. E. Fisher, E. R. Ott, A. V. Feigenbaum (chairman), M. E. Wescott, S. S. J. Skolnik, R. M. Berg, W. R. Weaver, W. G. Thompson.

by Mr. Zobel for the 30 members and guests who assembled in the "Melody Room" of Robert's Restaurant.

Dorsey E. Dean, Firestone Tire and Rubber Co., is scheduled to present "QC at Firestone" at our Dec. 11 meeting.

HARRISBURG . . . Robert Lusser, a German Missile scientist in World War II and now one of this country's leading authorities on reliability, addressed an enthusiastic audience at the RCA plant in Lancaster on Oct. 8. The meeting was jointly sponsored by the section and the Lancaster subsection of IRE. Mr. Lusser talked on "Reliability through safety margin."

The Dec. 3 meeting will be a dinner meeting at Hostetter's in Mount Joy and will be of special interest to management in the area. J. Fred Verigan, manager of QC at Crown Cork & Seal Co., will be the guest speaker. Mr. Verigan will present "Selling plant personnel on QC."

Following the resignation of Stephen Combs as section chairman, George Thomas of RCA Lancaster has succeeded him. At a special meeting of the section's executive committee, Mark E. Ryder, quality control manager of the Hamilton Watch Company of Lancaster, was selected as vice chairman to replace Mr. Thomas.

HUNTSVILLE . . . William E. Andrus of IBM gave an interesting presentation of the "Application of computing machines to the solution of statistical problems" at the September meeting.

KANKAKEE-JOLIET . . . The first meeting of the new season was held Sept. 8 in Kankakee. Mary Egges, program committee chairman, announced the 1958-59 program. This will be mailed to the plant managers of every industry in Kankakee-Joliet and surrounding towns as well as to the membership.

President Garr Burt announced an intermediate course in QC which will be offered at Joliet Junior College.

The speaker for the Sept. 8 program was George P. Schrader of the University of Illinois who spoke on "Operations research."

LIMA . . . The section's regular meeting featured Dr. Julian H. Toulouse who spoke on "Training in QC." His address was followed by a plant tour of the facilities of the Goodyear Tire & Rubber Co., St. Marys.

Gordon H. Robertson, education chairman, got his fall educational program started with two of the four courses he will conduct. At this time he is presenting a basic course in SQC and a measurement clinic. These courses will be taught by John Hower and Paul Caruso, respectively, both section members.

MEMPHIS . . . Dr. Boyd Harsbarger, head of the department of statistics of Virginia Polytechnic Institute, addressed the Sept. 8 meeting. His informative talk was given on "Designs of experiments for industrial use."

METROPOLITAN . . . The section has just concluded (Sept. 6) another successful Rutgers Conference attended by approximately 480 people. Subject matter ranged widely but general topics, both basic and management, were most popular. A ladies program was held for the first time and was well received.

It's getting close to that time again. Another Princeton Conference is coming along on Friday and Saturday, Dec. 5-6, so put that red circle on your calendar. This one is to be co-sponsored with the ASA. It will be an all-day Friday and Saturday morning conference copped by a luncheon on Saturday. The conference customarily draws a gathering of QC talent reaching into the topmost echelons. On Friday night

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IX-2.....	X-2.....	XI-2.....	XI-7.....
IX-3.....	X-3.....	XI-3.....	XI-8.....
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a social gathering will be held which might be unique for this type of affair. The Friday night gathering is a beer party. Result? The people with the know-how mix socially with all who want to know and the stage is set for a beneficial and interesting evening for all.

MID-HUDSON . . . Forty-five members and guests attended the first regular meeting on Sept. 2 at the Anchor Inn, Poughkeepsie. Chairman Frank Sindelar opened the business meeting with a breakdown of the agenda. Reports were given by treasurer William Beneshen and 1st vice chairman William Cranston. Richard Hulnick, committee chairman for the New England Conference, gave a comprehensive report. A breakdown of the 1958-59 program was given by program chairman Wallace Stone. Plans for interesting new members in joining the section were discussed by membership chairman Dwight Bellinger.

The speaker for the Dec. 2 meeting to be held at the Gov. Clinton Hotel in Kingston will be Sidney Fielden of IBM, Poughkeepsie. His topic will be "Statistical dimensioning."

MILWAUKEE . . . The Sept. 16 meeting was held at the Stratford Hotel. Fifty members and three guests heard a very interesting presentation by Dr. Julian Toulouse entitled "Finding the facts before setting the specifications." Dr. Toulouse, of course, needs no introduction to ASQC members. Prior to the regular meeting, 30 people attended a training session on "Fundamentals of probability," presented by William Golomski, past chairman of the section and currently operations research director at Oscar Mayer Co., Madison.

The Dec. 15 meeting will be the annual "Ladies Night" affair and entertainment will be provided by Lt. Harold Pheland of the West Allis Police Department and Elmer Kummer of the Miller Brewing Co.

MONTREAL . . . On Sept. 24 the section held its introductory meeting in the mess of the McGill University Officer's Training Corps. Discussion on various topics concerning QC made up a very interesting meeting. Subjects discussed were "How to sell management on QC" which covered the practical applications as well as individual problems of the members. G. S. Williams, vice chairman, presided over the meeting.

The speaker for the Dec. 10 meeting will be Dr. P. J. Sandiford, director of operations research for Trans Canada Airlines, Montreal.

Kingston-Brockville Sub-Section . . . The sub-section held its first meeting in the Aluminum Laboratories conference room. The highlight of the evening was an address by B. H. Lloyd, management consultant for Price Waterhouse & Co., Montreal. Mr. Lloyd's address, "Review of QC organization and case histories," aroused keen interest in the members, in particular when the points illustrated by examples of how industries were able to improve their products by the sound application of statistics and how these improvements were passed on to the consumer.

Plans were announced for a course in industrial statistics to be conducted this winter at Queen's University by the department of extension.

Ottawa Sub-Section . . . With the assistance of the Montreal section, the initial all-day forum was held on Sept. 17. Five lectures dealing with technical and administrative aspects of quality control were given by J. B. Pringle of Bell Telephone Company of Canada, M. O'Callaghan of British American Oil Co., E. N. Beckett of Northern Electric Co., and R. N. Chandler of Computing Devices of Canada, Ltd. This was followed by a spirited panel discussion under the guidance of E. C. Longhurst of RCA Victor Co. Thirty persons attended this successful session.

MUNCIE . . . September saw two good starts. Our twenty hour training course got under way Sept. 9 with 48 students representing 13 industries. Instruction duties are shared by section members D. G. Browne of the Broderick Co., R. D. Dawson of Warner Gear, and one of the best friends a section ever had—Art Bender of Delco Remy Div., GMC, a member of the Indianapolis section.

The program season was launched in excellent fashion on Sept. 18 when General Electric's Stanton A. Yingling addressed our opening meeting on "Total quality control." It was management night and the talk was expertly tailored to the audience. A beautiful job!

Seems almost impossible, but it's time to mention that we will not meet in December.

NEW HAVEN . . . Our first meeting of the 1958-59 year was held as a picnic at Echo Ridge Farms and was enjoyed by 37 members and guests.

The Dec. 9 meeting should be of interest to all. Mr. Scagna of Westinghouse Electric Corp. will present "Management of resident inspector program." Mr. Scagna is known as an authority on this subject.

NORTHEASTERN INDIANA . . . The section opened its 1958-59 program with a get acquainted meeting at the Falstaff Hospitality Room. President Joe Cline introduced officers and new members. Program chairman Howard Spicer outlined the program for the year. Plans were discussed for the next meeting which was to feature a "bosses night."

Starting in December, extensive progressive training sessions in quality control methods will be conducted. These instructional programs will be presented during the hour preceding each monthy meeting held on the second Thursday at the Chamber of Commerce in Fort Wayne. This extra bonus feature is under the direction of J. E. Goldress and M. Comerford, education committee.

OMAHA-LINCOLN . . . The September meeting, held at Marchio's in Omaha, was guest night. Twenty members and ten prospective members attended. G. E. Owens, quality control administrator for Convair of Fort Worth, Texas spoke on "The benefits of QC."

PENSACOLA-MOBILE . . . The first meeting was held Sept. 16 at the Officer's Club at Brookley AFB. A total of 81 persons attended including 46 from Pensacola representing a cross section of the major industries and the Naval Air Station. Guest speaker of the evening was Donald A. Gardiner of the Oak Ridge nuclear laboratories and a member of the Society. He spoke on new methods for controlling mathematically product quality and used as an example the treating process used at Oak Ridge to limit the release of radioactive waste.

PITTSBURGH . . . The first meeting of the fall was held on Sept. 23 at the downtown Wood Street YWCA. Truman Koehler of American Cyanamid Co. spoke on experiences that his company had with "Evolutionary operations." He reviewed somewhat the work of G. E. P. Box but devoted the major portion of his talk to applications.

Milton Aronson, editor of "Instruments and Automation," attended the meeting and reported on the entire instrumentation and automation course that the section had participated in during the past year. He thanked the section for its cooperation and hoped that the course would be given again this year.

The Dec. 9 meeting is planned as a joint affair with the local section of ASA at which time Alfred Schneider of

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SECTION CALENDAR (NOVEMBER 25—DECEMBER 31)

SECTION	DATE	PLACE	TIME	SUBJECT	SPEAKER
Allentown-Bethlehem	Dec. 10	Hotel Traylor	8:00 pm	Quality Control Procedure	J. T. Skelton, Caterpillar Tractor Co.
Baltimore	Dec. 16	Baltimore Memorial Stadium	8:15	Work Sampling in a Nation Wide Field Organization	Albert Mindlin, Bureau of Old-Age and Survivors' Insurance
				Management Uses of Work Sampling in a Nation Wide Field Organization	Albert E. Wells, Bureau of Old-Age and Survivors' Insurance
Battle Creek-Kalamazoo	Dec. 12	Sutherland Paper Co., Kalamazoo	8:00	What's Your Problem?	Panel of area QC managers
Boston	Dec. 12	MIT Faculty Club-Sloan Bldg., Cambridge	8:00	Quality Control's Role in Reliability	Panel Discussion
Buzzards Bay	Dec. 9	Continental Screw Co., New Bedford	8:00	Round Table Discussion	———
Chattanooga	Dec. 9	Hotel Patten	6:30	Application of Computing Machines to the Solution of Statistical Problems	W. E. Andrus, Jr., IBM Corp.
Chicago	Dec. 4	University of Illinois, Navy Pier, Room 218	7:15	Basic Educational Series	Peter K. Kuffner, William Lieberman
Cincinnati	Dec. 10	Engineering Society Bldg.	8:00	The Use of Sensory Testing in Flavor QC	David R. Peryam, Quartermaster Food & Container Institute
Cleveland	Dec. 5	Cleveland Engr. & Scientific Center	8:00	Food Taste Testing	Mrs. Mavis B. Carroll, General Foods Corp.
Columbus	Dec. 11	Jeffery Mfg. Co.	8:00	The Story of the Cutting Edge	The DoALL Co.
Corning-Elmira	Dec. 9	CGW Plant, Big Flats	———	Plant Tour	———
Cumberland	Dec. 4	———	6:30	Case History of QC Program at a Glass Refractories Plant	Alan Stone, Corning Glass Works
Dallas-Fort Worth	Dec. 11	Texas Instruments Auditorium	8:00	Inference from Numerical Data	Leroy Foulkes, Texas Instruments
Dayton	Dec. 4	Delco Products Division, GMC	8:00	Rework & Scrap Understandable to Production	D. B. Tallon, Convair
Evansville-Owensboro	Dec. 16	Princeton	8:00	Plant Tour of Potter & Brumfield Company	Fred A. Wilhite, Potter & Brumfield, Inc.
Greater Muskegon	Dec. 11	Cumerford's Restaurant, Holland	6:30	Quality Control at General Electric	A. V. Feigenbaum, General Electric Co.
Hamilton	Dec. 11	Canadian Westinghouse West End Plant	8:00	Quality Control at Firestone	Dorsey E. Dean, Firestone Tire & Rubber Co.
Harrisburg	Dec. 3	Hostetter's, Mount Joy	6:30	Selling Plant Personnel on Quality Control	J. Frederick Verigan, Crown Cork & Seal Co.
Hartford	Dec. 1	———	———	The Latest Developments in Measuring to 0.1 Millionth of an Inch	Albert M. Dexter, Pratt & Whitney Co., Inc.
	Dec. 2	Club Alden	6:30	Executive Committee Meeting	———
			6:30	Dinner	
	Dec. 16	Club Alden	8:00	Quality Controls in Complex Assembly Operations	Albert E. Aubin, Gray Mfg. Co.
Kankakee-Joliet	Dec. 1	Tony's Restaurant, Joliet	6:30	Sampling	Winston D. Dalleck, McKinsey & Co., Inc.
Los Angeles	Dec. 3	Rodger Young Auditorium	6:00	Professional Standards for Quality Engineering	David A. Hill, Hughes Aircraft Co.
			8:00		
Metropolitan	Dec. 5-6	Princeton University	———	———	———
Mid-Hudson	Dec. 2	Hotel Gov. Clinton, Kingston	7:00	Statistical Dimensioning	Sidney Fielden, Fedders Quiggan Corp.
Milwaukee	Dec. 15	Marquette University	6:00	Ladies' Night	———
Montreal	Dec. 10	CIL Bldg.	8:15	What does Operation Research Hold for the Q. C. Engineer?	Dr. P. J. Sandiford
New Haven	Dec. 9	New Haven College	8:00	Management of Resident Inspector Program	Ben Scagna, Westinghouse Electric Corp.
Northeastern Indiana	Dec. 11	Chamber of Commerce, Ft. Wayne	8:00	Factors Affecting Visual Inspection Performance	Dr. L. G. Mitten, Northwestern University
Omaha-Lincoln	Dec. 12	Omaha	7:00	Trip Into Russia	George Woodward
Ottawa	Dec. 11	National Research Council	8:00	Q.C. Administrative Applications	C. I. Taylor, Trans-Canada Air Lines
Pittsburgh	Nov. 25	YWCA, Wood Street	8:00	Basic Quality Control	Dr. Julian H. Toulouse, Owens-Illinois Glass Co.
	Dec. 9	YWCA, Wood Street	8:00	Applications of Multi-variate Analysis	Alfred M. Schneider
Pittsfield	Dec. 3	———	———	Q. C. and Me	Quality Control Management Panel
Portland	Dec. 2	———	———	Should the Production Process Establish A.Q.L.	Audience Panel Participation
Rhode Island	Dec. 18	Providence Engineering Society Building	8:00	Job Shop Techniques in the Refractories Plant	Alan Stone, Corning Glass Works
Rochester	Dec. 2	C. Of C.	6:15	Multi-variate Analysis	Harry Smith, Procter & Gamble Co.
	Dec. 8	C. Of C.	6:15	Specifications and Sampling Techniques	Dr. Ahimud Kramer, Univ. of Maryland
	Dec. 16	C. Of C.	6:15	Quality Control Techniques in Work Measurement	Dr. Gerald Nadler, Washington University
St. Charles	Dec. 10	Skakeproof Inc., Elgin	2:00	Plant Tour	———
St. Louis	Dec. 3	Alton Box Board Company	7:30	Plant Tour	———
San Antonio	Dec. 9	Hilton Hotel	7:30	Annual Christmas Party and Dance	———
San Francisco Bay Area	Dec. 8	Stanford International Inn	6:30	Experiments Multiple Comparisons	Dr. Robert Bechhofer, Cornell University
Syracuse	Nov. 25	Syracuse Turners Club	8:00	Quality Control and Standards	James L. Harris, Standard Pressed Steel Co.
Toronto	Nov. 26	Sign of the Steer	6:30	Reliability Requirements	Air Materiel Command Quality Control Representative
	Dec. 10	University of Toronto	8:00	Human Relations in Quality Control	A. Cooper, Honeywell Controls Ltd.
Tulsa	Dec. 15	Bordens Cafeteria, Sheridan Village	6:00	Training of Statisticians for Industry	Dr. Carl Marshall, Oklahoma State University
Univ. of W. Ontario	Dec. 10	Stratford YMCA	8:00	Who Controls Quality and How	Warren R. Purcell, Raytheon Mfg. Co.
Washington	Nov. 26	Roosevelt Hotel	7:00	LIFO versus FIFO Means of Issuing Supplies	Joseph A. Greenwood, United States Air Force
Windsor	Dec. 17	Mario's Restaurant	6:30	Childrens' Christmas Party	Santa Claus
Youngstown	Dec. 4	New Philadelphia	6:30	Plant Tour	———

American Cyanamid will discuss "Applications of multivariate analysis."

PITTSFIELD . . . Over 40 members turned out for the first meeting of the season at the Stanley Club on Sept. 10. Al Hunt, USAF, presented an excellent talk entitled "What the Air Force expects of its contractors in QC." The program was of extreme interest to members and guests—particularly to the many local industries which are present or potential government suppliers.

Plans are being made for the Dec. 3 meeting which will feature a local QC management panel on the subject of "QC and me." Members of the panel will be Fred Hartwell of Peter J. Schweitzer, Inc., John Landers of General Electric Co., and Joseph LaMountain of Byron Weston Co.

PORTLAND . . . Interest in the Saddoris Award is increasing throughout the section. Progress is being made for the 2-day Northwest Conference to be held by the section. The dates have been established as the last Friday and Saturday in March. The program is partially finished and the location has been narrowed down to three places.

Regretfully reported—Richard Lyon, tool design supervisor of Precision Castparts Corp., has been ordered by his physician to cease all outside activity. Dick, a very active member, was chairman of the membership committee and always handled ASQC duties with enthusiasm and almost limitless energy. We shall all miss his help. Roger S. Erickson, chief inspector of Continental Can Co., has been the assistant chairman and is familiar with the program already established. Roger has agreed to assume the duties as chairman. The section is very fortunate to be able to have a person of Roger's capabilities on deck at this time. Good luck, Roger—take it easy, Dick!

RHODE ISLAND . . . Our program for 1958-59 started on Sept. 18 with Richard A. Callahan, head of quality engineering at the U. S. Navy Central Torpedo Station in Newport, presenting an interesting paper titled "Quality assurance procedures as they relate to government acceptance procedures."

The October meeting featured "Continuous lot plot and VOSP procedures." Truman Read, staff assistant to the chief inspector of the United Aircraft Hamilton Div., Windsor Locks, Conn., was the speaker.

ROCHESTER . . . The technical sub-group will have as speaker at their Dec. 2 meeting Harry Smith of Proctor & Gamble. Mr. Smith will deal with multi-variate analysis.

The food and beverage sub-group will meet on Dec. 8 to hear Dr. Ahimud Kramer of the University of Maryland speak about "Specifications and sampling techniques."

The regular section meeting on Dec. 16 will be a joint affair with the Industrial Engineering Society. Dr. Gerald Nadler, head of the department of industrial engineering at Washington University in St. Louis, will discuss "Quality control techniques in work measurement."

The section started the season with two very well attended meetings. The Sept. 16 meeting was addressed by Prof. S. D. S. Spragg, University of Rochester. His topic was "Some contributions of engineering psychology to man-machine performance." On Sept. 23 the gaging and measurement subgroup met with Robert D. Brandon, Detroit Arsenal. Mr. Brandon gave an excellent talk on "Gage and inspection problems and related solutions in QC." An extensive slide presentation was included and both were very well received.

ST. CHARLES . . . Prof. Charles R. Hicks, Purdue University, addressed the opening meeting on Sept. 16 with "Fundamentals of analysis of variance." This is the paper for which Prof. Hicks received the Brumbaugh Award at the Annual Convention last May. Prof. H. Raymond Swensen, Illinois Institute of Technology, spoke to a pre-dinner educational seminar on "Probability."

The section is sponsoring an inspection training course in metrology at the St. Charles High School. The program is conducted by Edwin M. Pearne, consultant in precision measurement. Classes began Sept. 4 and will run for 15 consecutive weeks.

The Dec. 10 meeting will consist of a plant tour through the Shakeproof Division of Illinois Tool Works, Elgin, Ill.

ST. LOUIS . . . The September meeting was addressed by Seymour T. R. Abt, divisional operating manager of workrooms and material handling of Stix, Baer & Fuller Co. department store. His subject was "Relationship between QC and OR."

Mr. Abt extended an invitation to section members to attend the national convention of the Operations Research Society of America which was held in St. Louis in October.

SAN ANTONIO . . . The section held its first meeting on Sept. 9 at the Hilton Hotel. Charles T. Shewell of Humble Oil and Refining Co., Baytown, presented "Your Society and you." Mr. Shewell's address was very informative, timely, and interesting since a better knowledge of the functions and services of the Society were well explained. He placed particular emphasis on the fact that each member should strive to take an active part in Society matters in order to "reap the harvest" both for themselves and the Society. A question and answer period followed his talk and a lively discussion took place.

The appointment of Earl W. Doiron to serve as general chairman of our first all-day symposium to be held in San Antonio in January or February of 1960 was also announced. This event marks another "first" for the San Antonio area. We are small in number, but we are growing!

SAN FRANCISCO BAY AREA . . . About 230 members and guests enjoyed the well rounded program of the Fifth Annual Bay Area QC Conference on Sept. 19 at Stanford University. The Conference was sponsored jointly by Stanford's department of industrial engineering and the section. Dr. Joseph M. Pettit, school of engineering dean, gave the opening address. He was followed by ten eminent speakers whose papers covered a wide variety of applied SQC.

Courses in basic SQC are being conducted in the evenings at Hillsdale High School in San Mateo, San Leandro Adult School, Foothill Junior College in Mountain View, and at Sequoia High School in Redwood City.

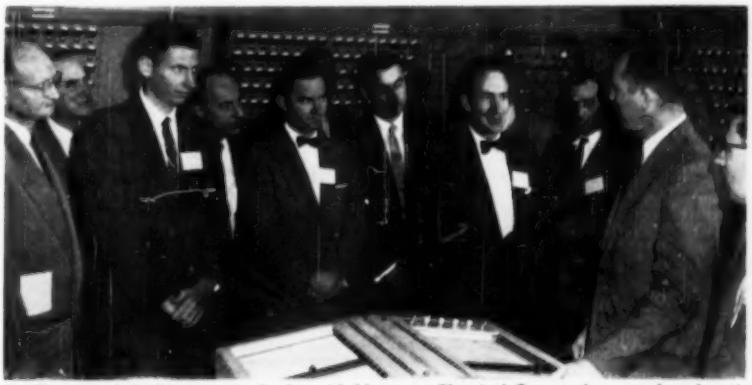
SOUTHERN CONNECTICUT . . . The October meeting featured Prof. Paul Clifford, chairman of the Society's Committee on International Co-operation. Prof. Clifford has spent a year abroad traveling throughout Europe with the U. S. Government team studying QC techniques and teaching the methods developed in this country. The evening was a combination travelogue and technical education period. In this day of increased international co-operation, this was a timely subject and the section was happy to have obtained one of the best qualified speakers to discuss it. Prof. Clifford is professor of mathematics at Montclair State Teachers College.

ST. LOUIS REGIONAL CONFERENCE

The recent regional conference sponsored by the St. Louis section was held at the general offices of Monsanto Chemical Co. Approximately 115 ASQC members and representatives of numerous corporations in the area were in attendance.

At the meeting, the members heard a report on the first attempted "moonshoot" only hours following the launching of the Air Force's "Pioneer" lunar probe vehicle.

The all-day program featured speakers from General Electric Co., the Department of Defense's Bureau of Ships, Aerojet-General Corp., as well as those from our hosts, Monsanto.



Dr. Theodore J. Williams, group leader with Monsanto Chemical Company's research and engineering division, explains the operation of Monsanto's PACE analog computer to a group of conferees. The computer can simulate an eight-hour experimental run in 90 seconds.

Publication Notice . . . . Again Available

. . . . *the second printing has just been completed*

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• • • Its *Worksheet* is a model of compactness, containing all of the data, information, calculations, analysis and graphic results on a single page. Anyone who can make out an Income Tax can follow the steps with ease.

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SOUTH TEXAS . . . C. T. "Tiny" Shewell more than made the "grand tour" during September giving his talk on the Society to the following sections: Waco, San Antonio, South Texas (Houston), Dallas-Fort Worth, and Albuquerque, New Mexico. It was a very fine presentation and aroused much interest.

SYRACUSE . . . The section welcomed back Leon Bass, QC manager for the Jet Engine Department of General Electric Company, as guest speaker at the September meeting. Mr. Bass, a former member of the section, was greeted by many old friends and his presentation was well received by a large audience.

TENNESSEE . . . Bruce R. Boals of the Ford Glass Plant was recently appointed Saddoris Award chairman for the section.

On Sept. 22 a meeting was held at the Tennessee Eastman Research Laboratories at Kingsport to discuss plans for the new section contemplated in that area. The program consisted of two moving pictures of general interest plus short talks depicting the activities and aims of the Society. The final outcome of the meeting will be reported next month.

Prof. David Chambers was a guest speaker at the meeting of the Knoxville Society of Certified Public Accountants on Sept. 9. The subject of his talk was "Statistical methods for auditing and accounting."

TOLEDO . . . On Sept. 11 Dr. Otto Zmeskall, school of engineering dean, and Ernest W. Weaver, Jr. gave a combined talk on what's ahead in engineering for Toledo University. The facilities of the new engineering building were explained together with courses offered including statistics. The meeting was a dinner-business affair held at Angelo's.

TORONTO . . . Our first plant tour of the season was made possible by courtesy of the Pilkington Glass Co., Scarboro and the 30 members who attended spent a most interesting evening being conducted through the complex and exacting phases of glass manufacture.

The annual golf tournament, held at Pickering on Sept. 20, was an unqualified success. The event was well attended and competition keen over the usual nine holes. After an excellent buffet supper, prizes were distributed by Murray Smith, social committee chairman. Murray was responsible for the day's activities and it was the unanimous opinion of those present that the arrangements had been well planned and nicely executed.

Unforseen circumstances have prevented Wing Commander G. Waterman from speaking at our joint meeting to be held Nov. 26. The revised program appears in the "Section Calendar."

TULSA . . . The first QC course began on Sept. 22 at Will Rogers High School. Prof. E. R. Ashworth, industrial engineering school of Oklahoma State University, is the lecturer. With an attendance of over 50 people for the first lecture and several more enrolling the following week, the course appears to be headed for success. The class has brought in several new members, some of them from out-of-town. Since this was the first attempt at a course of this type in Tulsa, we thought we were being overly optimistic when we ordered 30 books for the course. Needless to say we ran short in a hurry, as did the publisher, but by the second meeting we hoped to be able to supply one and all.

We want to thank the forward thinking companies in our area that paid for their employee's tuition and books. There are as many as nine persons from one company that are attending the course.

UNIVERSITY OF WESTERN ONTARIO . . . On Sept. 10 a general meeting was held at the YMCA in London. The scheduled speaker, Miss Marjorie M. Baskerville, cancelled due to illness and was very capably replaced by M. D. Nicholson of Timken Roller Bearing, Ltd., St. Thomas. Mr. Nicholson spoke on his own personal experiences in setting up and operating a QC program at Timken. The enthusiastic response from the audience was an indication of the fine presentation.

UTICA . . . The kick-off meeting was held at Grimaldi's Restaurant.

The large enthusiastic turnout was addressed by Rocco L. Fiaschetti, ASQC executive director. Mr. Fiaschetti spoke on various methods by which sections can carry out well rounded, interesting programs.

Following Mr. Fiaschetti's talk, a lively discussion was led by the panel of section officers—chairman R. Clonan, vice chairman R. Pilger, secretary R. Morton, and treasurer D. Conklin.

Judging from the interest of all members in attendance, it looks like 1958-59 will be Utica's best season yet.

WASHINGTON . . . The September dinner meeting held at the Roosevelt Hotel had as its speaker Dr. W. J. Youden of the National Bureau of Standards. Dr. Youden, in his talk entitled "Testing test procedures," discussed a means for interpreting results of dual-sample tests through graphical presentation. The method shows clearly and simply the presence of laboratory bias and the validity of sampling by considering the arrangement of plotted points with respect to the expected arrangement of unbiased results. The 40 plus members present were appreciative of the excellent presentation.

WESTERN MASSACHUSETTS . . . At the first meeting of the year, J. Gilman of Bay State Abrasive Products Co., Westboro gave a talk on "Quality—a team effort."

Two courses are being given this year in conjunction with the Massachusetts University Extension Service. The first, basic SQC, began on Sept. 29 at the Longmeadow Junior High School and is being taught by S. Lezinski, R. Goulart, and H. Edelstein. The second course, operations research, began Oct. 15 and is being taught by J. Hinchen, superintendent of planning and control at Monsanto, at the West Springfield High School.

WICHITA . . . The first dinner meeting of the 1958-59 season was held at the Shirkmere Hotel on Sept. 9. A. J. Myers of the Boeing Wichita Division was the principal speaker and discussed the "Quality control structure within the Boeing Company." It was interesting to note that the Boeing subcontract program engages 3467 actual subcontract sources in 45 of the 48 states.

The first all-day educational forum was held on Oct. 11 at the Coleman Co. The guest speaker was Gayle W. McElrath, head of the industrial engineering division of the University of Minnesota. The luncheon speaker was Bentley Barnabas, president of Associated Personnel Technicians, Inc.

WINDSOR . . . The section members were fortunate in having a plant tour through the Hiram Walker & Sons plant. The guides were very helpful in answering all questions that the members asked about their modern and huge capacity distillery. This company has played an important role in the history and growth of Windsor. Modern QC methods are used extensively throughout the plant. A quality level must be maintained to conform to strict government liquor laws. Mr. Harris formally thanked the group for their attendance and the group was given an imperial farewell in one of the finest Canadian clubs available to the section. Sincere thanks to Mike Sekela for his part in the arrangements.

The forum executive is actively arranging the 1959 forum. Details will be announced later.

YOUNGSTOWN . . . The new season got off to a good start with the following officers: Robert V. Jones, chairman; Paul D. Belter, vice chairman; Harold A. Hardman, secretary; and William J. Cain, treasurer. The following were appointed committee chairmen or co-chairmen: program—Paul D. Belter, William S. McHenry, and Charles E. Weitz; membership—Robert E. Baxter and Ronald A. White; Saddoris Award—Fred Benco; education—W. A. Griffith and Richard C. Patterson; and publicity—Fred Eboch.

The program committee has engaged six fine speakers and arranged two excellent plant tours for the coming season. All meetings will be preceded by a dinner since it has been found that a steak dinner is the best way to begin an evening of good fellowship.

It is not commonly known that the section covers a large geographical area. This is a disadvantage in that some members must travel great distances to attend meetings. On the other hand it gives us the opportunity to meet and know members in industrial environments altogether different from our own. It also provides us with interesting plant tours such as the visit to the Warner-Swasey Co., New Philadelphia, on Dec. 4.

SIGNIFICANT DIFFERENCES

. . . Allentown-Bethlehem—Charlie Dursee has been promoted to the reports and control section of the QC department at Western Electric. Charlie was 1957-58 publicity chairman.

Miss Bonnie Small presented a talk on quality control to the Reading Chapter of ASTE.

. . . Boston—The following are recent position changes by members of the section: Prof. Herbert J. Ball, Professor Emeritus, Lowell Tech Inst., Lowell; John D. Beal, Jr., industrial engineer, U. S. Navy Ammunition Depot, Hingham; James C. Bognore, QC specialist, General Electric, Lynn; Homer A. Clouster, quality analyst, Raytheon Mfg. Co., Waltham; Raymond Danisewicz, chief QC inspector, Bolta Products Div., Geneva Tire, Lawrence; William A. Donovan, senior QC engineer, B. F. Goodrich Co., Watertown; Howard

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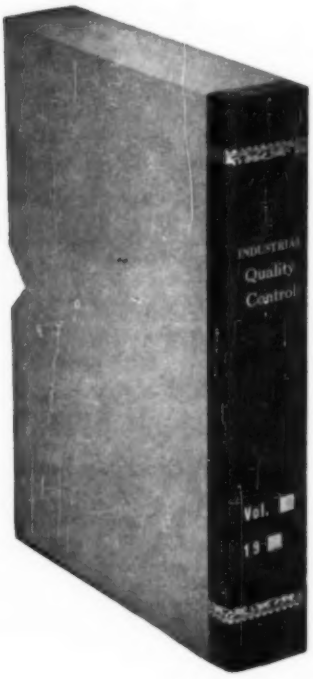
The bar is silver for Member grade and 10K gold for Senior and Fellow grade. It comes in either the horizontal bar or chain type. Sections wishing to use these for awards to past chairmen or other members will find them especially suitable. The surface of the bar, which is shown here slightly larger than actual size, is plain so that your message or citation can be engraved on it.

Your office or den is the place to display this. An 8 × 10 membership certificate suitable for framing with your name creatively inscribed. Your professional affiliation increases your stature with company and business associates. Let them know you belong to ASQC.

Have trouble keeping track of your *Industrial Quality Control* magazines? Make them a permanent part of your business or home library. These famous Jesse Jones files are especially designed to keep your copies orderly and readily accessible at all times. These durable files in light blue and gray Kivar covers guard against soiling, wear, tearing and misplacement of copies. Each file box will keep a complete volume — 12 issues — in perfect condition. (Back Volumes from I-XI will fit into five boxes.)



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N. Dudley III, supvr. QC engineering, Sylvania Electric Products, Waltham.

. . . Charleston—The section has missed Edward O. Lail since his promotion to AT&T in New York. We should be reading soon of his activities and wish him well in his new position.

. . . Cleveland—Fred Newman, formerly with Goodyear in Akron, is now associated with American Vitrified Products of the same city as a die designer.

Paul Kuckuck, junior past chairman of the section, has been promoted at Weatherhead Co. from QC manager to technical advisor to the aviation and missile division.

While on his sabbatical leave from Western University where he is chairman of the statistical department, Dr. J. N. Berrettoni is doing research work in experimental design and reliability.

. . . Columbus—Roy B. Cowin, Jr., a past chairman of the section, will teach an introductory course in SQC including control chart techniques to the Columbus Foreman's Club.

. . . Corning-Elmira—Recent changes at the Corning Glass Works resulted in Walter H. Crompton becoming QC supervisor at the Big Flats plant. Walt previously held the same position at the Harrodsburg (Kentucky) plant.

Richard J. Gibson was transferred to the Harrodsburg plant of CGW as a QC engineer. Dick was previously section publicity chairman.

. . . Cumberland—Recently promoted at the Ameelle Plant of Celanese Corporation of America was John S. Sirockman, Jr. Mr. Sirockman, previously a senior QC engineer in the extrusion and cellulose compounds section, is now assistant extrusion manufacturing superintendent.

. . . Dallas-Fort Worth—Dr. and Mrs. A. W. Wortham are the proud parents of a baby daughter. Dr. Wortham was 1957-58 section chairman.

. . . Evansville-Owensboro—Ed Shafer has resigned as chairman of the section. He is moving to Sacramento, Calif. to accept a position with the Aerojet-General Corp.

Floyd C. Johnson has moved up from vice chairman to chairman and Fred A. Wilhite has been elected as vice chairman due to Mr. Shafer's resignation.

. . . Georgia—Ivan L. Lester, senior member, is now a technical director of the Mead-Atlanta Paper Co., Atlanta. He was formerly works manager of Georgia Kaolin Co., Dry Branch, where he had previously been technical superintendent. As a past chairman of the Georgia section, he will again be contributing to section activities.

. . . Hamilton—Congratulations to chairman W. C. Luton on his recent appointment as manager of the service department-appliance division, Canadian Westinghouse. Bill formerly carried the title of superintendent-quality control in this same division.

. . . Harrisburg—Stephen A. Combs, former section chairman, has accepted a position with the special products division of the Whitehead Corp., Cleveland. Mr. Combs has been a very active member of the section and Cleveland's gain will be our loss.

. . . Lima—John Hower, Richard Peggs, Joseph Mayer, Robert Park, Donald Roethlisberger, Lloyd Harvey, Leo Connors, and Darrell Fultz pursued their study of statistics in a course offered by Ohio Northern University, Ada.

. . . Memphis—Edward P. McMahon of Nickey Brothers, Inc. was presented with an ASQC tie clasp for his outstanding work in founding the section. In accepting, Mr. McMahon said he had enjoyed his work in ASQC and was fortunate in having assistance from all of the membership.

. . . Mid-Hudson—Carl Sage of Boice Gage, Inc. was appointed as chairman to handle the by-laws for the section.

. . . Milwaukee—Robert Evans, section arrangements chairman, was recently promoted from ass't. chief inspector to chief inspector at the Blackhawk Mfg. Co.

. . . Montreal—William A. Lewis, former section membership chairman, is now production superintendent with the Tuckett Tobacco Co., Hamilton.

D. K. Kingston of the United Tobacco Co. of South Africa was a visitor to the September section meeting.

H. Vance Ward, immediate past chairman of the section, toured Great Britain giving lectures on SQC under the sponsorship of the British Productivity Committee.

. . . Montreal, Kingston-Brockville Sub-section—Dr. J. W. Wilkinson, formerly of the mathematics department of Queen's University, has accepted a position with Westinghouse Corp., Pittsburgh.

. . . Pittsburgh—Richard F. Gireselman has been transferred by Westinghouse Electric Corp. to Bloomington, Ind.

Arthur S. Cobert has left the American Cyanamid Co. to join Westinghouse Atomic Power at Bettis Field.

. . . St. Louis—John Marshall, former section reporter, is now associated with Larry Smith & Co., Washington, D. C.

. . . Southern Connecticut—Samuel A. Oliva, Dictaphone Corp., will manage the company's new plant at Concord, N. H.

Stanley Rosoff formerly with Raybestos Division, is now with the consulting laboratory of Pitney Bowes, Stamford.

David Albert, formerly chairman of the New Haven section, is now QC engineer at Norma-Hoffman Bearings Corp. He is also a member of the University of Bridgeport faculty.

. . . Toronto—Section members Alex Lucas, Tom Monaghan, Mike O'Callaghan, and Walter Pukalo will be mainly responsible for the presentation of a course in QC at the University of Toronto.

. . . Tulsa—Mr. Lawson of Sylvania Electric Products has been advanced to the position of supervisor of product engineering. R. W. Childress will replace Mr. Lawson as supervisor of quality control in Shawnee.

clinics, conferences, and courses

NOVEMBER

. . . **30-Dec. 5**—ASME Annual Meeting, Hotels Statler-Hilton and Sheraton McAlpin, New York City, sponsored by American Society of Mechanical Engineers, contact L. S Dennegar, Director of Public Relations, American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y.

DECEMBER

. . . **3-5**—Eastern Joint Computer Conference & Exhibit, Bellevue-Stratford Hotel, Philadelphia, Pa., co-sponsored by IRE, ACM, AEEI, contact William E. Bradley, Registration Vice Chairman, Philco Corp., CGI Div., Philadelphia, Pa.

. . . **29-30**—Section M (Engineering) of 125th Annual Meeting of AAAS, Washington Statler Hotel, Washington, D. C., sponsored by American Association for the Advancement of Science, contact Secretary, Section M (Engineering), AAAS, c/o Engineers Joint Council, 29 West 39th St., New York 18, N. Y.

JANUARY

. . . **27-30**—15th Annual SPE Technical Conference, Hotel Commodore, New York, N. Y., sponsored by Society of Plastics Engineers, contact William C. Cleworth, Publicity Chairman, 15th Annual SPE Technical Conference, 342 Madison Ave., New York 17, N. Y.

FEBRUARY

. . . **3**—Quality Control Management and Engineering 15-week course, University of Rhode Island, Division of University Extension, Providence, in cooperation with the Rhode Island section of ASQC, contact Alberto J. La Greca, 20 Fenwood Ave., Esmond 17, R. I.

. . . ***6-7—Middle Atlantic Conference, Traymore Hotel, Atlantic City, N. J., sponsored by ASQC, two-day conference featuring four simultaneous sessions with papers and discussions by leaders in the field, contact R. G. Mitchell, General Chairman, International Latex Corp., Playtex Park, Dover, Dela.***

. . . **6-7**—Eleventh Annual Industrial Engineering Institute, conducted simultaneously on the Berkeley and Los Angeles campuses of the University of California, contact Department of Conferences, University Extension, University of California, Berkeley 4 or Los Angeles 24, Calif.

What's New?

ROY A. WYLIE, *Editor*

When inquiring about "What's New?" items, please mention INDUSTRIAL QUALITY CONTROL

A new Model 150 improved professional-type transistor tester has been announced. The Model 150 is universal, testing PNP or NPN, audio, r.f., power, or industrial transistors. Sockets, binding posts, and leads are available for all types of transistor terminals. Junction and other diodes may be tested accurately for forward to reverse current ratio. A self-contained, extra-heavy duty long-life mercury cell supply gives freedom from hum, low impedance power source, and contributes to the stability of the readings. The Model 150 accurately measures junction transistor Beta, the actual grounded emitter current gain. Beta is read directly on a meter on scales of 0 to 50 and 0 to 250 Beta. Leakage current, Ico, is read directly on meter scale, 0 to ma., for power transistors, 0 to 50 μa., and 0 to 200 μa., for other transistors. Beta measurement is made with a calibrated, small a.c. signal, from a built-in generator containing a transistorized LKC oscillator with buffer amplifier for isolation. Provision for calibrating its output is on front panel. The transistor is biased to a standard collector current during test. The bias circuit is independent of signal circuit. Power transistors are biased at 0.1 amp. collector current, others at 1 ma. collector current. The size of the unit is 14 × 8½ × 7⅝ inches, and the net weight is 9½ lbs. The price is $179.50.

For further information, please write in P-1 on the coupon which appears on page 36.

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A new line of air gaging capsules has been developed. The Air Capsule is a small, air-actuated pick-up of the direct contact type. It is used with any CompAIRator Air Gage to provide fast visual readout with quick response. Extreme accuracy is possible because of the high magnifications available in the CompAIRator. In addition, the Air Capsule is available in a special long-range model which is designed for wide tolerance gaging, having a range of 0.004 to 0.040 inches. The Air Capsule comes in both plain and threaded body types and measures only 1½ inches long × 0.375 inches diameter. The plain body Capsule replaces standard A.G.D. Dial Indicators with 0.375 inches diameter shanks to provide infinitely greater accuracy through higher magnifications and wider dial range. Using simple attachments, it may easily be clamped on height gages and surface gages for many surface plate or on-machine inspection jobs. The threaded body capsule is generally fixture-mounted to take advantage of its extra fine pitch threads for critical positioning. The Air Capsule is equipped with carbide contact points, 3-foot air hoses complete with threaded fittings, and can be supplied permanently mounted in 90 degree adaptors to eliminate tubing bends.

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A window-reading micrometer of West German make is being offered. In the new micrometer the "quarter" divisions of 25, 50, and 75 on the sleeve and possible resultant confusion are done away with. Instead the sleeve bears only graduations in 10ths of an inch. The 100ths are read through the window numbered 0 to 9, while the 1000ths appear on the thimble, opposite the 10,000ths vernier, but perfectly flush with each other. The micrometer is truly decimal or digital without any other computation and is perfectly continuous. The other important advantage claimed for the new micrometer is, of course, the flush reading for the second, third, and fourth digits, completely free of parallax.

For further information, please write in P-3 on the coupon which appears on page 36.

★ ★ ★

The completion of a new direct-reading x-ray fluorescence instrument for analysis of all elements above atomic No. 11 has been announced. Simultaneous analysis of up to 22 elements in the wavelength range 0.35 to 10.2A is provided from a single sample. The Production X-ray Quantometer utilizes the principle of analyzing the fluorescence caused by bombardment of the sample with high intensity x-rays. Each element emits fluorescent radiation at a characteristic wavelength. Measurement of the intensity of this radiation by various detectors provide accurate quantitative analysis of each element in the sample. The analytical system is composed of three units, the Power Source, the Spectrometer, and the Recording Console. Through a ratio recording system the instrument provides permanent, inked records showing concentrations of all elements analyzed. The PXQ significantly widens the wavelength range available for simultaneous analysis. The resulting economies in time and labor—and the increased accuracy—represent a sizeable forward step in automatic spectrochemistry.

For further information, please write in P-4 on the coupon which appears on page 36.

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The Mahr 890 Involute Measuring Machine, combining extremely fine accuracy with short inspection time for checking involute tooth flank profiles on spur and helical gears, bevel gears, and worm gears, is now available. Reduced testing time on the Mahr 890 is provided by an infinitely variable, optical, base circle setting for gear diameters between 0 and 20 inches, without need for base circle discs. This also permits the testing of very small gears and pinions. Extremely accurate checking is guaranteed by a highly sensitive, shock-proof stylus and a recording magnification of 500 and 1000×. Roll ratios are adjustable to 1 to 1, 2 to 1, and 4 to 1. Another feature of the Mahr 890 is its ability to check bevel gears by means of a holding device. This unit can be swung through 105 degrees (−15, + 90) and is set with slip gage blocks. For inspection of internal gears an off-set stylus is used. All working parts of this machine are supported on a heavy, rigid base. The stylus and measuring parts are completely protected against dust. Friction is reduced to a minimum by ball bearing guides for the main slide and recorder slide, and by chromium-plated guide ways. Gears to be inspected are held either on arbors or between centers to a maximum distance of 16 inches. Both centers are carbide-tipped. The driver is adjustable to any shaft diameter. Pitches from DP 1½ to DP 50 can be inspected with a standard set of gaging points. Surface finish of tooth flanks can also be checked and re-

HOWARD L. JONES

has retired after 35 years' service with Illinois Bell Telephone Company. At the time of his retirement, he was a general supervisor of statistics in the accounting department. Howard joined Bell as a clerk following his graduation from the University of Illinois where he was a member of Phi Beta Kappa.

"Mr. Statistics," as Howard is affectionately known, is now a professor of statistics at the University of Chicago.

AIIE Abstracts

The American Institute of Industrial Engineers is proud to have published the first series of abstracts of research performed in the field of industrial engineering. Many industrial personnel and university faculty members have found this information helpful in their research work, classroom presentations, and in solving practical industrial engineering problems.

The ultimate objective of the Research Information Committee, AIIE, is to obtain a complete compilation of all completed industrial engineering research work. A second survey concerning research completed between July 1, 1947, and July 1, 1952, is about to begin. The committee would appreciate receiving research abstracts of work performed during this period. Organizations which did not fully complete the listing of their research for the period July 1, 1952, to July 1, 1957, should include abstracts of this information in the second survey. Cooperation of everyone concerned is essential to make this undertaking completely successful.

The committee will appreciate all information on industrial engineering research past and present, about which it might gather more specific details. Write:

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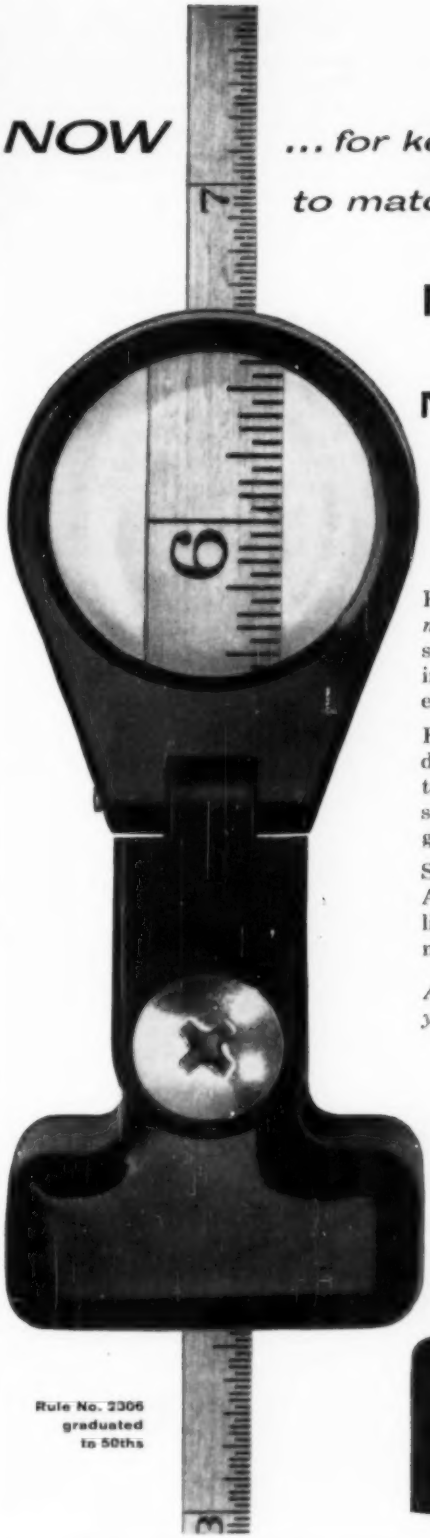

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★ ★ ★

Two direct vision type spectroscopes have been introduced as part of a new line of scientific instruments. One, Model F-361, is designed for practical use by the field worker and laboratory technician. It is a prismatic type, hand-held, direct-vision instrument that has many features of the standard laboratory spectroscope. Its focusing 400-800 millimicron scale, with adjustable split field enables one to identify spectral lines and make comparisons between light sources. High grade dispersion prisms, adjustable slit-width and fine optics yield an intense spectrum with highly resolved lines. Absorption spectrum analysis is also possible with this spectroscope, making it one that can be used in many scientific and technological areas; such as color and dye chemistry, blood chemistry, medicine, criminology, metallurgical analysis, gas tube manufacture, etc. The price of this instrument is $76.50. The other spectroscope, designated F-359, is a simpler version designed for student use for demonstration of the solar spectrum, Fraunhofer lines and bright line emission spectra. The slit width is also adjustable and focusable; a high grade series of prisms and the optical system yield an intense spectrum of good resolution. The price of this instrument is $19.50.

For further information please write in P-6 on the coupon which appears on page 36.

★ ★ ★

A new lead tester, combining the ability to check the lead of straight or taper threads; internal or external threads; and taper of threads or cylinders, has been announced. The Model A Electro-Mechanical Universal Lead Tester is designed for use in inspection rooms and gage laboratories. Range of the instrument is from 1¼ to 16 inches in diameter, and external threads ranging from 0 to 16 inches, on work as heavy as 500 pounds. It was designed to meet the demand for checking the lead and taper of API gages, which were often too large or too heavy for the conventional methods of checking work between centers or mounted on V blocks. Because of its universal features and extra capacity, the Model A Lead Tester is ideal for checking all types of lead on thread gages and precision products. Direct readings are made to 0.00002 inches for lead, and to 0.0001 inch for taper by means of the ELECTROLIMIT gaging principle incorporated in the gaging machine. In checking threads the zero reading is established by gage blocks, and is then compared to the position of a ball point in the thread. The variation from zero is indicated on either or both the lead and taper ELECTROLIMIT scales, depending upon the elements being checked. Interchangeable gaging spindles and ball points are provided to check a full range of thread pitches.

For further information please write in P-7 on the coupon which appears on page 36.

★ ★ ★

The development of a new, seven-pound arbor press for determining the caking characteristics of powdered materials is announced. The new product, which measures only 11 inches high and can be utilized for both field and laboratory work, is also suited for checking springs, plastics, rubber, sockets and similar items. The new unit consists of a mechanical force gauge with red maximum pointer, placed upon the lower platen of a press, directly beneath a removable ram. For checking powdered materials, a cylindrical cup is mounted to the gage. This cup has a removable inner ring which may be filled with fertilizers, chemicals, medicines, or other powdered materials. Once filled, the ram of the press is lowered and force is applied to specification. The inner ring is then removed, leaving a compressed pellet of the desired size. Final test load is brought to bear against the pellet until it crumbles, thus giving exact knowledge of the caking characteristics of the material under different conditions of moisture, temperature, etc. Ring fixtures may be replaced with any desired shape to check out other industrial materials. The new arbor press is available in five gage capacities: 10, 25, 50, 100 or 250 pounds. A professional laboratory case with locking snaps is included.

For further information please write in P-8 on the coupon which appears on page 36.

★ ★ ★

The development of the Cleveland Roughness Meter is announced. This instrument is the answer to the requirement of the metalworking industry for a surface measuring instrument at a price within range of any budget. It is more versatile, with less equipment. The widest range of surface shapes (outside diameters down to 0.30 inches, inside as low as 0.25 inches) can be measured with the basic equipment—no additional adaptors or accessories are required. The basic Roughness Meter consists of a pick-up, amplifier and handle. It may be operated hand held or with power trace. Readings are unaffected by temperature, humidity and/or magnetic fields. Its precision calibration and construction exceed all military and industrial standards. Simplicity of operation is due to clearly marked controls, skids, and adjustable tolerance hands.

For further information please write in P-9 on the coupon which appears on page 36.

★ ★ ★

Production is now in effect on the new Macbeth Quantalog Densitometer. The Quantalog is a series of attachments built around a high quality photometer. The Quantalog is direct reading 0 to 4.0 density units. (Meter has optical density scale printed in black and the Transmission and Reflectance scale printed in red to avoid confusion.) Accuracy is ±0.02 density units over the entire scale, when being used with either the Transmission Attachment or Reflection Head Attachment. Because the unit uses a 25 watt input it has no "heating up" problem. Full scale sensitivity is 4.0 density units with an excitation of only 0.01 microlumens at 2840 degrees K. At present two attachments are in production, a Reflection Head Attachment and a Transmission Attachment, and it is expected that a Digital Readout Attachment will be offered in a very short time. The basic unit and attachments are finished in two-tone gray with a satin chrome and contrasting ebony black nameplate. The basic Quantalog Photometer is designed to sell for under $400 and the Reflection Head or Transmission Attachment, for about $200.

For further information please write in P-10 on the coupon which appears on page 36.

★ ★ ★

Announcement of the new TOLIMIT Screw Ring Comparator has been made. Gauging threaded parts with this instrument is simple. The thread

anvils are actually segments of rings. One tolerance pointer is set to the GO pitch diameter by a calibrated setting plug; the other tolerance pointer is set to the NO GO pitch diameter by the scale on the dial. With the handle in LOAD position, a part is placed in the gauge. With the handle in FULL FORM position, a part is rotated about 90 degrees and the dial reading checked with the handle in the P.D. position, a part is again rotated about 90 degrees and the dial reading noted. With the handle in the LOAD position, the part may be removed from the gauge. Readings on the Comparator are repeatable 0.0002 inches. It checks both full form and pitch diameter, and cannot be forced. The comparator is rugged in design and construction and has no pivots. The cost is less than equivalent ring thread gauges.

For further information please write in P-11 on the coupon which appears on page 36.

★ ★ ★

The availability of the PEI ABRASION TESTER, which was originally developed in 1952 by the Porcelain Enamel Institute Research Associateship at the National Bureau of Standards, is announced. The instrument is designed to provide a simple, but accurate, means of testing and comparing the abrasion resistance of porcelain enamel finishes. It may be used for testing any type of porcelain enamel finish regardless of the degree of smoothness of the surface, including the wavy, eggshell or orange-peel types of finishes. (A standard test procedure has now been set up for the industry. Copies of the bulletin describing the test procedure entitled "Bulletin T-2, Test for Resistance of Porcelain Enamels to Abrasion" are available at 50¢ from the Porcelain Enamel Institute, Inc., 1145 Nineteenth St., N.W., Washington 6, D. C.) The PEI Abrasion Tester consists of a synchronous motor-driven table which gyrates in a horizontal plane at a frequency of 300 cycles per minute, so that every point on the table describes a circle ⅞ inch in diameter. The length of the test can be controlled by a counter-timer, and nine symetrically-mounted specimen holders are provided, each accepting a sample up to 4½ inches square. Both the table and the base are durable aluminum castings, and the material and workmanship of the Abrasion Tester conform throughout to accepted laboratory instrument practice. Specimens to be tested are clamped in any one or more of the nine holders on the table, and are covered by rubber-gasketed watertight retainers. The abrasive charge, consisting of 175 grams of $\frac{5}{32}$ inch stainless steel balls, 3 grams of abrasive grain and 20 ml. of water, is added through a hole in the top of the retainer, and the Abrasion Tester is then set to operate through the desired cycle. The degree of abrasion is evaluated in terms of change gloss (for surface abrasion) or loss in weight (for sub-surface abrasion). Other uses for the instrument are evaluating the durability of highway paints and other paints and varnishes, waxes and linoleums, testing the serviceability of ceramic, plastic and fibrous materials, and comparing the abrasive qualities of household cleaners.

For further information please write in P-12 on the coupon which appears on page 36.

★ ★ ★

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A new 35mm Film Comparison Viewer has been announced. The Viewer is used for quality inspection and comparison of nearly identical reels of 35mm film. With forward and reverse speeds up to 300 feet per minute and rewind speeds up to 1000 feet per minute, provided by a variable speed drive motor, the Viewer operator can inspect in a single operation up to four separate film strips driven concurrently over the 9 inches wide by 18 inches long illuminated viewing area. The film drive is accomplished by sprockets fixed to a common shaft for maintaining frame synchronization. The drive voltage direction is determined by a forward-reverse switching circuit and the film strips are driven in unison — forward or reverse — by means of drive and speed controls for film transport. Torque motors are provided to supply proper film tension. The motor armature resistance for controlling film drive speed can be varied by means of a powerstat operated by a front panel drive knob. The electrical system of the 35mm Film Comparison Viewer operates from a 115-125 volt, 60 cycle, single-phase power source.

For further information please write in P-13 on the coupon which appears on page 36.

★ ★ ★

The Model FC-30ER Extended Range Optical Comparator for the inspection of extra-large, heavy parts, is in production. Up to 10 inches of lateral measurement is provided, with a rugged roller mounted, heavy duty table. Accurate vertical measurement up to 8 inches, is permitted through the new double spindle table support. This double spindle construction, combined with the 8 × 32 inches heavy duty table, provides sufficient rigidity for movement and measuring of heavy objects weighing 200 pounds or more. It is now possible to project over and under objects up to 8 inches in diameter without interference with either the lens or viewing screen. The Model FC-30ER is the largest standard 30 inch Optical Comparator and Measuring Machine made. The Comparator is hooded and provided with curtains so that the operator can control screen contrast, regardless of surrounding light conditions. All standard Comparator attachments are available for the FC-30ER, including Normal and Oblique Surface Illumination, Tracing and Photographic attachments and Over-lay Chart Rails.

For further information please write in P-14 on the coupon which appears on page 36.

★ ★ ★

To assist producers and fabricators of films, strips, and foils to see how continuous thickness control can help to lower production costs and improve quality, "on-the-job" demonstrations of the Measuray noncontact x-ray thickness gage will be conducted. A standard model Measuray gage, consisting of the x-ray scanning unit and an electronic generator with built-in setting control is carried about the country in a station wagon. It can be set up and in operation on a producing or sorting line within an hour. The new demonstration service is available, without charge or obligation, to producers and fabricators of plastic film, cellophane, rubber, paper, glass, foils, and thin metal strips, such as copper, brass, steel, aluminum and precious metals. The gage features an ultra-fast gaging cycle, enabling it to be used with high-speed electronic sorting and classifying devices, automatic strip thickness controls, recorders and other accessories. Its low-intensity X-rays scan films and foils as thin as 0.0002 inches, speeding by at rates up to 100 feet per second.

For further information please write in P-15 on the coupon which appears on page 36.

★ ★ ★

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Mail the handy coupon below to obtain further information about any of the items appearing in advertisements or new products and new literature described in the "What's New?" department, pages 32-37.

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New Literature Available

The construction, application and operation of ring dynamometers are discussed in a new bulletin. The four-page, two color bulletin describes in detail the accuracy of the ring dynamometer as a force measuring instrument. It lists both the general and dimensional specifications of standard capacity ring dynamometers.

For further information please write in L-1 on the coupon which appears on page 36.

◆◆

Highly stylized, do-it-yourself instrument and control centers, designed for industrial and medical laboratories, libraries, schools and institutions, are reviewed in a new bulletin. Called Research and Engineering Stations, the flexible work centers consist of continuous table tops supported at desk height by arrangements of storage units. The four-page bulletin shows how the system combines work surface with area storage to suit individual needs in a manner that saves much of the space previously wasted under tables.

For further information please write in L-2 on the coupon which appears on page 36.

ASQC Personnel Listing Service

A new service exists for the use of ASQC members only. Any member desiring to be listed as available for new employment opportunities should send a brief resume (on 3 × 5 file card, or cards) to ASQC Personnel Listing Service, Room 6197 Plankinton Building, 161 West Wisconsin Avenue, Milwaukee 3, Wisconsin.

All information will be kept confidential and those listed will be sent descriptions of all suitable opportunities for 60 days following receipt of this initial listing. If it is your desire to remain on the list after this period, you can do so by writing in to the same address and requesting an additional 60 day period. If you do *not* request an extension, your resume will be removed from the file on the assumption that you have made a successful connection.

Companies wishing to post positions available in the ASQC Personnel Listing Service should address all correspondence to the same address as above giving the educational and experience requirements, age and salary limits on each position. The position description should be limited to 100 words plus the complete name and address of the individual to whom resumes should be sent.

A combination catalog and informative handbook has just been printed and is available. General Catalog #10 consists of 114 pages, 8½ × 11 size, with high gloss, stain resistant covers, and plastic binding. Over half its content is well organized information on the highly technical subject of optical gaging, chart-gages and fixturing. The book is indexed with die-cut tabs covering sections devoted to Chart Layout Methods, Standard Chart-Gages, Micro-Gage Chart-Gages, Standard Accessories, Projector Tracers, Custom Chart-Gages and Fixtures, and Contour Transcribers. It is illustrated with large clear pictures and many of the pages are printed with a second color to aid illustrative effect.

For further information please write in L-3 on the coupon which appears on page 36.

◆◆

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BOOK REVIEWS

W. D. Baten, Editor

26 University Drive, East Lansing, Mich.

QUEUES, INVENTORIES AND MAINTENANCE, THE ANALYSIS OF OPERATIONAL SYSTEMS WITH VARIABLE DEMAND AND SUPPLY by Philip M. Morse, published by John Wiley & Sons, Inc., New York, 1958, price $6.50, pages ix-202. Reviewed by Dr. H. A. Freeman, Massachusetts Institute of Technology.

The area of application of probability and statistical theory to industrial problems is ever widening. During the early years of the American Society for Quality Control, application centered on systematic quality control and sampling inspection. Somewhat later, interest in the design and analysis of industrial experiments rose and is now at high level. Even more recently, and with a strong claim for attention, has come the field of operations research, and it is likely that a considerable number of the readers of *Industrial Quality Control* now are or soon will be interested in the activity of this area.

Operations research already has a modest general book literature of its own and is now beginning to produce books on specialized topics within the general area. The book at hand is in the latter class; it is the first of a series sponsored by the Operations Research Society of America. Its author is a professor at M.I.T. and one of the pioneers of operations research, his work having begun more than 15 years ago.

The central problem studied in this book is the following: units arrive at a facility, are serviced there and are discharged. The units may arrive at even or uneven rates, with rates known exactly or probablistically. There may be one or several facilities (if several, arranged in series or in parallel), with, at a given time, more than adequate service space (wasteful), adequate, or less than adequate space (queues will have to be formed). Various priority schemes may be applied to units waiting in the queue. The service itself may be constant or variable in time (and in cost). And so on. The problem is to formulate mathematically the interrelationships of these and other factors, to study the implications of these interrelationships, and to determine, if possible, economically optimal arrangements.

Examples are many. With modest extensions of the meaning of such words as "unit," "facilities," "service time," etc., they include such divergent activities as freighters arriving at ports, store sales, control of inventions, maintenance and repair of machines, design of library systems, parking lots, toll lanes, and lunch counters.

The range of the discussion in the book is natural and is easily guessed, given the problem to be solved. First, probability descriptions of arrival and service times, with means and variances. Second, the problems of a single facility with exponential (common) arrival and service-time distributions, with consideration of service cost, customer loss, customer impatience. Next, several exponential service channels arranged in parallel (only one service channel need be used), simulation of difficult non-exponential distributions to facilitate calculations, problems of handling queues. All of this and more is finally applied at some length to inventory control, with interest centering on the determination of optimal inventories, and to maintenance of machinery, single and many machines, one or more repair crews.

The reader will need to have a modest but working knowledge of differential and integral calculus, and of probability theory at an elementary to intermediate level.

FINITE QUEUING TABLES by L. G. Peck and R. N. Hazelwood, published by John Wiley & Sons, Inc., New York, 1958, price $8.50, pages xvi-210. Reviewed by Dr. H. A. Freeman, Massachusetts Institute of Technology.

These are tables to facilitate the solution of a variety of queuing problems such as indicated in the review of Morse's book. They were computed on UNIVAC I, and printed on the Univac high speed printer from the Univac magnetic tape;

Report of the Examining Committee

The Society takes great pleasure in congratulating the following members who have been elected to the grade of Fellow by action of the Examining Committee:

Name	Section
Richard S. Bingham, Jr.	Buffalo
Brant Bonner	University of Western Ontario
Frank Caplan, Jr.	Pittsburgh
J. Alfred Davies	Evansville-Owensboro
Harry L. Wehrly	Greater Detroit
Phillips Whidden	Pittsburgh

the book was produced by photo-offset from the machine printing. The authors are associated with the Operations Research and Mathematics Group of Arthur D. Little, Inc.

This is the second volume of the series sponsored by the Operations Research Society of America.

Let N be the size of the finite population (number of machines, number of customers, etc.), let T be the average service time (repair time, length of conversation, etc.), let D be the probability that if a unit calls for service, it will have to wait, let M be the number of service channels (repairmen, telephone lines, etc.), let U be the average idle time (running time, time not calling for service, etc.), let X be the service factor $(= T/T + U)$, let W be the average waiting time, let H be the average number of units being serviced $(= NT/T + W + U)$, let L be the average number of units waiting for service $(= NW/T + W + U)$, let J be the average number of units idle (running) $(= NU/T + W + U)$, let F be the efficiency factor $(= H + J/H + L + J)$. The tables show a very wide variety of combinations of N, X, M, D, and F, details of which would seem irrelevant in this review.

We give one example from the book. We have nine welders connected to a power system, each operating independently of the others. The *average* time of each welding operation is 9 seconds, and between each welding there is an *average* time of 91 seconds. We have

$$N = 9,\ T = 9,\ U = 91,$$
$$X = 9/9 + 91 = 0.090$$

From the tables, the probability of delay in getting power, for one service channel, $(M = 1)$ is 0.657. Though one channel is adequate for simple average demand, random variation in demand around the average makes one channel inefficient (from the standpoint of the welders). For

$M = 1$, $L = 0.98$
$M = 2$, $L = 0.099$
$M = 3$, $L = 0.009$,

the average length of the queue is seen to fall sharply with an increase in the number of channels. Also, since $T = 9$,

$M = 1$, average delay $= (0.98)(7) = 8.82$ seconds
$M = 2$, average delay $= (0.099)(7) = 0.891$ second
$M = 3$, average delay $= (0.009)(7) = 0.081$ second

The authors comment: "The cost of the lost time for the welders can be computed and measured against the cost of providing more service channels. The cost of the delay may include slower production rates as well as pay costs."

ASQC Announces

Advancements and New Members

(as of September 24, 1958)

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GAWENIS, RICHARD G., Clearwater, Fla.
GORGES, HAROLD M., Clearwater, Fla.
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KITTLE, FRANCES R., Celina, Ohio
KRAVA, GERARD J., Clearwater, Fla.
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CARTER, GEORGE W., Riverside, Cal.
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GREENE, ROBERT L., Chicago, Ill.
GRIESER, THOMAS F., St. Petersburg Beach, Fla.
GRUDGINGS, FRANK B., St. Petersburg Beach, Fla.
HANSSON, KAY H., Bromma, Sweden
HANYOK, PAUL, Alexandria, Va.
HARDEBECK, EDWARD J., Milwaukee, Wis.
HARRY, EDWARD G., Cudahy, Wis.

(Concluded on page 40)

1958 Shewhart Medal Nominations

Nominations are now being received by the Shewhart Medal Committee for consideration with respect to the 1958 Shewhart Medal Award. Previous Medalists are:

L. E. Simon	— 1948	H. G. Romig	— 1953
H. F. Dodge	— 1949	E. G. Olds	— 1954
M. A. Brumbaugh	— 1950	W. E. Deming	— 1955
G. D. Edwards	— 1951	M. E. Wescott	— 1956
E. L. Grant	— 1952	C. C. Craig	— 1957

A letter of notification is being sent to all ASQC Section chairmen. Any member of the Society is privileged to make a nomination for this honor. It is important, however, that any nomination be accompanied by suitable biographical and other information supporting the nomination so that the Committee will be able to give adequate consideration to the qualifications of the nominee.

Nominations should preferably be forwarded to the Shewhart Medal Committee through the Chairman of the local Section, but may be sent direct with supporting information (10 copies, please) to the Chairman of the Medal Committee, Lloyd A. Knowler, Department of Mathematics and Astronomy, State University of Iowa, Iowa City, Iowa. Nominations received by the Medal Committee on or before December 31, 1958, will receive due consideration.

(Continued from page 39)

HASENAUER, EDWARD J., San Diego, Cal.
HASSAN, ALFRED, Los Angeles, Cal.
HAYNES, WALTER J., Ashland, Mass.
HENNESSEY, PATRICK J., San Bernardino, Cal.
HENRY, EDWARD H., Fair Oaks, Cal.
HOFFERBER, WILLIAM R., Arlington, Cal.
HOFFMAN, M. H. JR., San Jose, Cal.
HUBBARD, MERTON R., Burlingame, Cal.
HUDSON, BERNARD A., Evansville, Ind.
HUDSON, RONALD E., Riverside, Cal.
JOHNSON, CAMPBELL C., JR., Pasadena, Cal.
KALESIA, WALTER L., Succasunna, N. J.
KELSNER, THOMAS, West Allis, Wis.
KIMBALL, FRED L., Corona, Cal.
KING, LEWIS, Philadelphia, Pa.
KIRBY, EUGENE, Tucson, Ariz.
KLEINHOFER, BURKHART A., Whittier, Cal.
KOGER, PAUL D., San Jose, Cal.
KRUSE, HENRY D., Bellevue, Wash.
KUENZI, WILLIAM A., Wauwatosa, Wis.
KUPS, EUGENE B., Roseville, Mich.
LADUE, HAROLD J., Walled Lake, Mich.
LARKIN, VINCENT D., Levittown, Pa.
LE VAN, ROBERT G., Beloit, Wis.
LINDA, JOHN W., Sacramento, Cal.
LISS, LOUIS D., Duncan, Nebr.
LISY, DONALD J., Chicago, Ill.
LONG, ROBERT L., Fort Wayne, Ind.
LUBY, JOHN P., Dallas, Tex.
MALSAN, EUGENE J., Yorkville, N. Y.
MANKOWSKI, JAMES L., Granger, Ind.
MARTIN, HOWARD, Minneapolis, Minn.
MASSARO, JOHN S., Roslyn Hgts., N. Y.
McALEER, JAMES E., Silver Spring, Md.
McCLAIN, JOHN N., Signal Mtn., Tenn.
McCULLOUGH, HUBERT F., Kingsport, Tenn.
McGLUMPHY, JAMES W., Roselle Pk., N. J.
McINTYRE, FREDERICK P., Battle Creek, Mich.
McKEE, TED R., San Diego, Cal.
McKESSON, ELMER E., Austin, Tex.
McMASTER, ALEXANDER C., Glendora, Cal.
McMILLAN, DAMON L., Santa Clara, Cal.
MICHAEL, MARVIN J., Riverside, Cal.
MILLER, RONALD R., Anaheim, Cal.
MODZELEWSKI, JOHN J., Philadelphia, Pa.
MOORE, Z. O., Chattanooga, Tenn.
MOREFIELD, J. EDGAR, Fullerton, Cal.
MORIATY, JOSEPH A., JR., Kingsport, Tenn.
MOSHIER, LEON S., JR., Kitchener, Ontario, Canada
MURPHY, JAMES E., Johnson City, N. Y.
MUSSER, CLAUDE E., JR., Binghamton, N. Y.
MYERS, HARRY N., Philadelphia, Pa.
NEWSOME, LEWIS E., W. Covina, Cal.
PACKARD, DONALD H., Saratoga, Cal.
PATCHELL, STEPHEN F., Pomona, Cal.
PATRICK, ROBERT A., St. Petersburg, Fla.
PATTERSON, CLIFFORD, St. Petersburg Beach, Fla.
PENDZIMAS, DONALD J., Minneapolis, Minn.
PICKERING, GORDON L., Honolulu, Hawaii
POLLHAMMER, FREDERICK, JR., Baltimore, Md.
PRATT, WILLIAM H., Beloit, Wis.
PRELL, EUGENE G., Melrose Park, Ill.
PRESTON, BRUCE A., Utica, N. Y.
PRO VORSE, PAUL E., Beatrice, Nebr.
RANKIN, ARTHUR N., Nichols, N. Y.
RANKIN, CARL E., San Bernardino, Cal.
REILLY, FRANK, Abilene, Tex.
RENAUD, RALPH F., Syracuse, N. Y.
RICHARD, RONALD J., Montreal, Quebec, Canada
RIVAY, ELMER C. JR., Milwaukee, Wis.
ROLAND, JOSEPH E., Sunnyvale, Cal.
RUGH, ROBERT L., Anaheim, Cal.
RYAN, RUSSELL T., Chicago, Ill.
RYBAKOFF, GEORGE, Newark, N. J.
SANDLAND, GEORGE W., Fanwood, N. J.
SAVILLE, JOHN, Utica, N. Y.
SCARAMELLA, GERTRUDE M., San Bernardino, Cal.
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SLIND, MELVIN V., St. Paul, Minn.
SMITH, ROBERT W., Binghamton, N. Y.
SNYDER, LAURENCE E., St. Clair Shores, Mich.
STANDLEY, ARTHUR W. JR., Salem, Mass.
STANTON, BURR, Louisville, Ky.
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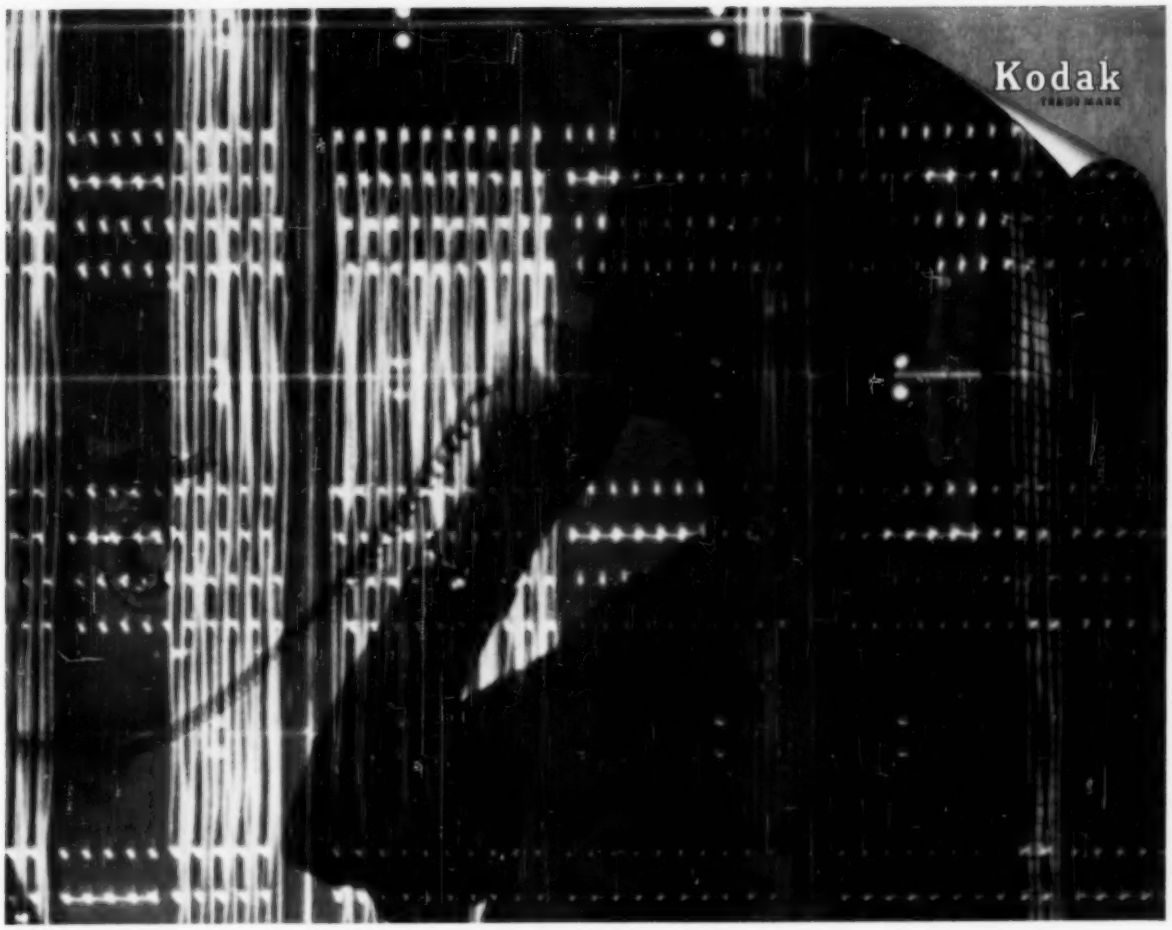

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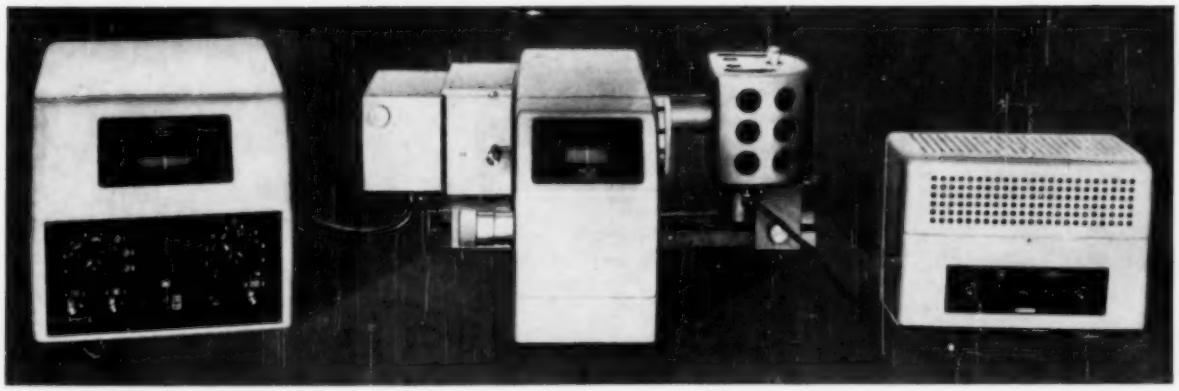

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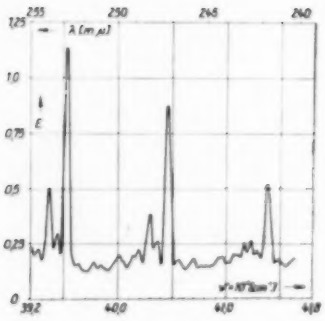

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